A SYSTEMS LEVEL FOCUS ON THE EFFICACY OF CLASSROOM SOUND FIELD AMPLIFICATION ON THE LANGUAGE DEVELOPMENT OF CHILDREN IN SEVEN URBAN DEIS PRIMARY SCHOOLS IN DUBLIN

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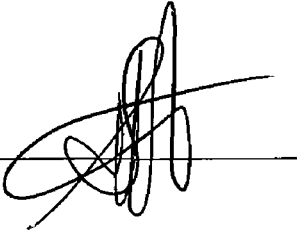
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Declaration

I hereby certify that this material, which I now submit for assessment on the programme of study leading to the award of the Doctorate in Philosophy of Education is entirely my own work and has not been taken from the work of others save and to the extent that such work has been cited and acknowledged within the text of my work.

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Abstract

This study adopts a systems theory approach in its focus on the efficacy of a classroom sound field amplification system (SFA) for the development of language in children aged 4-7 attending 7 designated disadvantaged urban schools in Dublin. The multi-method case study design combines norm-referenced and dynamic language assessments to create multi-dimensional language profiles of 65 study participants. These profiles are augmented by observations of the elements of the child and classroom systems that maximise or hinder the efficacy of SFA. A systems perspective on the efficacy of this intervention is innovative in the context of SFA research to-date, which has been conceptualised predominantly in terms of a simple linear one-antecedent-one-consequence causal relation. Thus, it is argued that while the literature on the benefits of SFA is large internationally, it is still seriously underdeveloped, as it brings little new meaning to the understanding of this intervention.

A series of case studies illustrate individual responses to the intervention. In addition to identifying situations in which SFA works, the analyses describe situations and environments where SFA does *not* work, thus introducing a heuristic element to the hypothesis, absent in previous SFA studies. SFA was found to bring particular benefits to children in junior infant classes, children with norm-referenced language delay at baseline and children with teacher-attributed attention difficulties, most notably in the area of language comprehension and classroom participation. The finding that children with weaker norm-referenced baseline profiles showed greater gains in the area of language comprehension than other study participants indicates that what is often termed the Matthew effect (Merton, 1968) was *not* observed in this study's results.

Overall, SFA is found to be beneficial under the assumption that it is brought into a system whose other elements are not operating in direct conflict with the goals of SFA. The findings of this study are in agreement with a systemic view of the education system and the somewhat obvious – yet ignored by previous SFA researchers – fact stemming from it, namely, that the same intervention may lead to different outcomes in different systemic conditions. Implications, based on key findings and interpreted within a systems theory perspective, refer to the professional development of teachers and to a need to interrogate theory more critically in other SFA intervention studies. This study constitutes the first large-scale study on SFA in mainstream education in an Irish context and the first study internationally that is entirely concerned with the effect of SFA on the language development of pupils in designated disadvantaged schools.

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Glossary of Terms and Abbreviations

Auxiliary services – services other than curriculum-based teaching of either therapeutic or educational or health care nature (e.g., regular school-based learning support in one-to-one setting, speech and language therapy in or outside of school, psychological interventions). They are specified in the report where relevant.

ADHD – attention deficit hyperactivity disorder

Clause/clausal utterance/response – utterance consisting of a subject (e.g., *I, dog, mammy)* and a predicate (e.g., *like, run away, went)* and any number of **modifiers** (e.g., adjectives) (e.g., *my, yesterday, red)*; such as: *I like giraffes, He went to the zoo* or *He is only joking*

Complex sentence – any multi-clausal utterance (clause consists of at least a subject and a predicate) with clauses in either subordinate or coordinate relationship (with the exception of conjoined with 'and' and 'then') (e.g., *I like elephants cause they are fat)*

Confidence interval – at interpretation of standardised test results, a score range that gives one confidence that the child's true score would lie within this range (e.g., 68% confidence intervals gives one 68% of such confidence)

DEIS – *Delivering Equality of Opportunity in Schools* – an action plan for educational inclusion launched by the Department of Education and Skills in 2005 and focused on addressing the educational needs of children and young people aged 3-18 in disadvantaged communities

DES – Department of Education and Skills

Dynamic assessment – assessment conducted in a naturalistic setting and frequently on the basis of more than a single time performance, as opposed to **static assessment** conducted in clinical conditions with the use of standardised tests

Expressive language – language mode that relates to production of language (i.e. expression of ideas and opinions), as opposed to **Receptive language** that relates to comprehension of language

Expressive vocabulary – vocabulary that is used by one in speaking, as opposed to **Receptive vocabulary** that is vocabulary that is understood (receptive vocabulary repertoire is normally larger than expressive vocabulary repertoire)

Equifinality – 'the fact that the same final state can be reached from different initial conditions and in different ways' (Bertalanffy, 1969, p. 79)

Frequency of occurrence of specific language behaviours – e.g., the number of times a child responded to an obligation to the number of all obligations he/she received or the proportions of specific language behaviours in the whole language sample (e.g., proportion of complex sentences in the total number of sentences)

Grammatical correctness – the proportion of grammatically correct **utterances** in all utterances produced

GST – General Systems Theory

HA – hand up

Interrogative utterance – utterance with rising intonation indicating inquiry/questioning (e.g., *What does it say here? Are you listening?)*

IRF – Initiation-Response-Feedback – a traditional model of classroom interaction described originally by Sinclair and Coulthard (1975), which is characterised by a teacher's initiation followed by a student's response, and a teacher's feedback on this response

Literate language – a style of language that is characterised by the use of conjunctions, elaborated verb phrases, adverbs, mental and linguistic verbs, and that is considered to be necessary for the development of good literacy levels

Loquacity – the proportion of **multi-clausal** responses in the total number of **clausal responses** produced

Modifier – a word that modifies a meaning of another word with which it creates a subordination relationship; a grammatical qualifier (e.g., *windy day, horrible witch)*

Morpheme – the smallest meaningful unit of speech (e.g., *in, -ing, re-, she, I, -s*)

Morphologically incorrect utterance – utterance that lacks obligatory morpheme or contains wrongly used morpheme (e.g., *I play yesterday, That is Dad bike, That is he bike*)

Multi-clause (multi-clausal) utterance/response – utterance consisting of at least two **clauses** (e.g., *I like elephants cause they are fat, He went to the zoo but his mammy didn't go, That's what he was saying)*

Otitis media (glue ear, fluid ear, inflammation of the middle ear) – 'fluid in the middle ear without signs or symptoms of infection' that affects the hearing (Shekelle et al., 2003, p. 10)

Participation – relation of the total number of combined 'volunteering for **response'** (**HA**) and 'not obligated responses' (self-initiated and volunteered responses) to the number of **teacher's questions**

Pragmatic appropriateness – the proportion of pragmatically appropriate and adequate responses in all *verbal and nonverbal* responses produced

Receptive language – language mode that relates to comprehension of language, as opposed to **Expressive language** that relates to production of language (i.e. expression of ideas and opinions)

Receptive vocabulary – vocabulary that is understood by one, opposed to **Expressive vocabulary** that is vocabulary that is used in speaking (receptive vocabulary repertoire is normally larger than expressive vocabulary repertoire)

Response – any child's contribution relevant to the classroom discourse which equals one conversational turn and thus may contain a few **utterances** and a few **clauses** (e.g., *My ma got a new telly for Christmas and I watched Chucky/Its scary*)

Responsiveness – relation of the number of child's **responses** to the number of **teacher's obligations**

RT – reverberation time

Single clause (single-clausal) utterance/response – utterance consisting of one **clause** only (e.g., *I like giraffes, He went to the zoo, He is only joking*)

SD – standard deviation

SFA – sound field amplification system

SLI – specific language impairment

SLT – speech and language therapist

SNR – signal to noise ratio

SS – standardised score

Static assessment - assessment conducted in clinical conditions with the use of standardised tests, as opposed to **dynamic assessment** conducted in a naturalistic setting and frequently on the basis of more than a single time performance

Syntactic complexity – the proportion of **complex sentences** in the total number of complete sentences produced

Teacher's obligation – teacher's utterance that solicits verbal response (information) from the child it is directed to (e.g., *Josh, can you tell me what happened at the end of the story?*)

Teacher's question – teacher's utterance that elicits verbal response (information) and is directed to the whole class (see appendix A) (e.g., *Does anybody know what happened at the end of the story?*)

Text-level utterance/response – as opposed to **word level utterance**, any utterance/response that *does not* operate on phonological, syntactic, semantic level of words (see **word level utterance**) and *is not* a number or a read out word (e.g., *That's hedgehog, I like this, Red, September, I got make up for Christmas cause I am good*)

Utterance – a unit of conversation that is grammatically independent (e.g., single word, single phrase, simple sentence, **complex sentence** uttered) (see chapter three for detailed criteria for its segmentation). It can contain one clause (**single-clausal utterance**) or a few clauses (**multi-clausal utterance**)

Verb – a word expressing an act, occurrence or mode of being

Word-level utterance – single word utterance/response that operates on phonological, syntactic, semantic level of words or that is a number or a read out word (e.g., *Give me an 'ing' word, What other words start with 'm'?, Who can read that word?, What number does it say?*)

Quantitative terms used and approximate percentage of occurrence (IDES, 2005b, p. 11):

Almost all – more than 90%

Most/mostly – 75-90%

Majority/mostly – 51-74%

Half – 50%

Fewer than half – 25-49%

A small number – 16-24%

A few – up to 15%

CHAPTER ONE

This chapter consists of two sections. The first introductory section provides a context and a rationale for the use of sound field amplification systems (SFA) in regular classrooms. This section is followed by the articulation of the research question and the outline of the thesis. The final and main section of this chapter presents a critical discussion on SFA literature to date and reports on the observed benefits of SFA on academic achievement, speech perception and attending and listening behaviours in the classroom.

Introduction

1.1 Context and Rationale

A sound field amplification system (SFA) installed in the classroom (through a series of loudspeakers on the walls and a microphone for the teacher transmitting the sound to them) amplifies and equalizes the teacher's voice throughout the classroom to increase the signal-to-noise ratio (SNR)[1], thus purportedly improving listening conditions and enhancing the quality of learning (Flexer, 2002). Classrooms are auditory-verbal environments that require accurate reception of a verbal speech signal from the teacher (Crandell &

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[1] Signal-to-noise ratio (SNR) refers to the audibility of the teacher's speech above the background noise level.

Smaldino, 2000, p. 371). By improving intelligibility as well as audibility, SFA enables the pupils to hear the teacher more clearly and more consistently.

Lehman and Gratiot (1983) reported that reductions in classroom noise via acoustical modification had a significant effect of increasing concentration, attention and participatory behaviour in children. Crandell and Smaldino (1995) concluded from a review of the literature that:

> Noise has been demonstrated to affect academic performance, reading and spelling skills, concentration, attention and pupil behaviour adversely (pp. 36-37)

Classroom noise that can be overcome by the sound field amplification system includes the sources of noise highlighted by John and Thomas (1957):

- External noise sources: refer to noise generated from outside the school building, such as vehicle or air traffic, construction, and playground areas,

- Internal noise sources: originate from within the school building but outside the classroom e.g., from the gym and/or busy corridors,

- Classroom noise sources: generated within the classroom itself, including, children talking or laughing, sliding of chairs or tables, shuffling of hard-soled shoes on non-carpeted floors, and school heating systems.

McSporran et al. (1997) highlighted that classroom noise is only one contributor to poor listening conditions, another two being distance and increased reverberation time (RT). Excessive noise may affect the *audibility* of a teacher's speech by masking it, while increased reverberation time may affect the *intelligibility* of a teacher's speech (Berg et al., 1996). RT is created when the sound reflects off hard classroom surfaces and, as McSporran et al. (1997) note, its levels are seldom within the recommended limits for optimal speech

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recognition for children.[2] Classroom noise, both internal and external, reflected sound, and loss of speech energy over distance combine synergistically to affect speech perception, i.e. together, their adverse effect on speech perception is greater than when the adverse effects of any one characteristic are considered (Crandell & Smaldino, 2000a; 2000b). Nelson and Soli (2000) conclude 'communication in classrooms often occurs in less than ideal acoustic conditions, and is complicated by multiple talkers, noisy rooms, reverberant walls and inexperienced listeners' (p. 356).

Audiologists recommend that in order to enable good listening, noise level in unoccupied classrooms should not exceed 30-35dB and occupied classrooms 45-50dB (American Speech-Language-Hearing Association, 1995; 2005; Crandell & Smaldino, 2008; Berg et al., 1996; Manlower et al., 2001). Some researchers found that a typical occupied classroom has a noise level averaging 60dB, which may reach up to 85dB at certain times of day in some particularly large classrooms in cities (Berg et al., 1996; Choi & McPherson, 2005).[3] In Rubin et al.'s (2007) study, all classrooms in one out of two studied schools failed to meet the recommended acoustic standards for favourable listening conditions (American National Standards Institute, 2002).

Acoustic standards for American classrooms were developed in 2002 (ANSI, 2002). They specify that in unoccupied classrooms, background noise should not exceed 35dB and reverberation time should not exceed 0.6 seconds. American SFA researchers suggest that SFA may play a pivotal role in the many classrooms that do not meet the acoustic standards requirements (Flexer et al., 1995; Rubin et al., 2007). However some researchers note that SFA may not be a

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[2] Reverberation time should not exceed 0.6 seconds (ANSI, 2002).
[3] Sound pressure doubles for each 3dB increase in the noise level (e.g., noise level of 52dB is 32 times higher than noise level of 37dB) (Rubin et al., 2007).

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solution for some excessively reverberant classrooms (Nelson & Soli, 2000).

New updated guidelines on school design developed by DES in an Irish context

recognise that all learning spaces should be sufficiently separated from each

other and from external noise sources (DES, 2010a). They, however, do not

specify acoustic performance factors and their standards (i.e. reverberation time,

signal-to-noise ratio). The guidelines recognise the importance of good acoustics

for learning:

> Acoustic performance is a primary determinant of a quality learning
> environment and the design should be capable of meeting or
> exceeding this essential functional requirement. Noise producing and
> noise sensitive spaces shall be located, designed and detailed so as to
> minimise noise interference between them. The sound insulation
> between classrooms of different activity, noise break-in, rain noise,
> room acoustics and their effect on speech intelligibility should also be
> taken into account during the design and detailing of the spaces (p. 12)

The impact of the classroom environment on teaching and learning has

been recognised in Irish schools also in a recent ESRI report on classroom and

school design titled *Designing Primary Schools for the Future* (Darmody et al.,

2010). The authors of this report note that 'the research linking acoustics to

learning is consistent and convincing: good acoustics are fundamental to good

academic performance' (Darmody et al., 2010, p. 18). They point to a scarcity of

empirical research on the design of the schools in Ireland amid a growing

international interest in studying the impact of built environments on children's

experiences. One can thus conclude that the importance of classroom acoustics

has still not been sufficiently recognised in an Irish educational system.

Earthman and Lemasters (1998) note that academic achievement is higher

in schools with less external noise and that excessive noise can cause stress in

pupils, which in turn impedes their learning. Researchers note that poor acoustic

conditions may be especially detrimental for younger children, especially children starting school (see Berg et al., 1996, for a review; Manlowe et al., 2001). Firstly, young children have immature listening skills related to the process of neuromaturation of the auditory system (Gil-Loyzaga, 2005; Moore, 2002). Secondly, the youngest learners do not have years of communication experience to fill in the gaps in communication (Manlowe et al., 2001; Massie & Dillon, 2006a). Furthermore, poor acoustical conditions may be an additional disadvantage to children who already experience comprehension problems, as noise may mask some words for them, making the speech even more difficult to fully understand.

Rosenberg et al. (1999) cite multiple studies evidencing the difficulties normal hearing children experience when listening in background noise (Berg, Blair & Benson, 1996; Crum & Matkin, 1976; Downs & Crum, 1978; Finitzo-Hieber & Tillman, 1978; McCroskey & Devens, 1975; Nabelek & Robinson, 1982; Papso & Blood, 1989). These studies support the claim that children need more favourable acoustical conditions than adult listeners to achieve equivalent recognition scores, by demonstrating that the children's performance decreases markedly in poor acoustical conditions. Millet & Purcell (2009) cite a number of more recent studies evidencing decreased speech perception and speech *understanding* of young children in the presence of noise (Bluestone, 2004; Gil-Loyzaga, 2005; Moore, 2002; Nelson & Soli, 2000; Stelmachowicz, Hoover, Lewis, Kortekaas, & Pittman, 2000).

Children listen differently than adults do and require a shorter reverberation time (RT) and higher signal-to-noise ratio (SNR) to achieve equivalent scores on speech perception (see Crandell & Smaldino, 2006b, for a

review). The recommended SNR for children younger than 15 is +15dB-20dB, in contrast with +6dB-8dB for a normal hearing adult (ASHA, 1995; see Manlowe et al., 2001, for a review of studies supporting this claim). In the Larsen and Blair's (2008) study, teachers' voice levels in four occupied classrooms[4] with 24-26 pupils in each class were on average only +2dB above the noise level (i.e. SNR +2dB). Larsen and Blair demonstrated that the use of SFA improved SNR to a recommended level in all four classrooms.

SFA was found by various international researchers studying regular classrooms to impact positively on attention (Allen & Patton, 1990; Eriks-Brophy & Ayukawa, 2000; McSporran et al., 1997), speech recognition (Bradley & Sato, 2004; Crandell, 1996; Jones et al., 1989), and further on language growth and a range of academic dimensions, such as verbal participation in the classroom (Sarff et al., 1981; Flexer, 2002, Heeney, 2004; Massie & Dillon, 2006a; 2006b; Rosenberg et al., 1999), as well as reading, spelling and writing (Darai, 2000; Heeney, 2004; Massie & Dillon, 2006a; Millet & Purcell, 2009; Rosenberg et al., 1999). Furthermore, excessive noise was observed to affect teacher's performance by contributing to teacher's fatigue (Crandel & Smaldino, 2006b). Palmer (1998) noted that by reducing the fatigue of both teachers and students, SFA contributes to more positive, energetic teaching and better learning. As there is some evidence that language and literacy difficulties are more prevalent in areas designated as disadvantaged, a claim that will be supported below, SFA has the potential to bring much benefit in these areas.

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[4] Classrooms were observed while the class was in session and the pupils interacted with the teacher and each other.

1.2 Research Question

The research question of this study is: *Can classroom sound field amplification (SFA) play a causal role in a system of elements to bring improvements for the specific population of young early primary children in urban designated disadvantaged schools on a number of language dimensions?* These dimensions are:

- Classroom participation

- Responsiveness

- Loquacity

- Syntactic complexity

- Pragmatic appropriateness

- Grammatical correctness

- Norm-referenced receptive language

- Norm-referenced expressive language

- Norm-referenced receptive vocabulary.

The research question introduces a focus on a refined, multidimensional model of language (the educational relevance of the studied language dimensions will be presented in chapter three) in the context of educational disadvantage through a systems approach. This study adopts a systems level focus on SFA efficacy upon the language development of children aged 4-7 from seven DEIS (2005) schools[5]. Following this approach, the context of other conditions supporting and hindering SFA efficacy will be explored.

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[5] DEIS schools are schools that participate in an action plan for educational inclusion launched by the Department of Education and Skills in 2005 and focused on addressing the educational needs of children and young people aged 3-18 in disadvantaged communities.

1.2.1 Analytical Frame for Research Question

The analytical frame for addressing the research question situates the studied intervention within a larger systemic perspective, which discusses the elements of the child's system including the classroom microsystem as potentially mediating the efficacy of this intervention. The research question, which proposes a causal attribution model, however conceptually situated within a systems perspective, is addressed in this study in two ways. Firstly, the efficacy of SFA is examined using the empirical model of a multiple baseline AB case study design (Kazdin, 1982), with research analyses conducted at three intersecting levels, namely, at a case study level, a class level and a language dimension level. Secondly, the elements of the child's system, with a specific focus on the microsystem of the classroom, are observed in terms of the conditions they create for this intervention. Thus, a systems perspective is introduced in this study to bring more meaning to the understanding of the functioning of the classroom sound field amplification in the classroom. This perspective goes beyond narrowly deterministic approaches in previous SFA studies that simply assume the benefits of this intervention as 'a given'.

Analyses of the classroom microsystems in this study are carried out in terms of the classroom context and the adult-child interactions. The classroom context is examined in terms of the size of the class, the size and the acoustic qualities of the classroom, the teacher's use of the provided microphones and the subject of the lesson taught at a time of the observation. The adult-child interactions are examined in terms of the presence and the frequency of open-ended questioning, the use of dialogic reading and language stimulation techniques (Girolametto et al., 2000; Girolametto & Weitzman, 2002;

Whitehurst et al., 1988; Zevenbergen & Whitehurst, 2003), the frequency of expository language enabling and the presence of shifting of power relations towards the children (Bronfenbrenner, 1979) (see chapter three for elaboration on the research methods underpinning this model). Furthermore, the productivity and characteristics of the children's language samples, the number of teacher obligations to individual children and the teacher questions directed to the whole class, as well as the relationship of these two measures, were quantified for each study participant. The results of the study are discussed within this systems theory framework.

The study critiques a lack of a systems focus in previous SFA research internationally and introduces a contextually based model of the classroom sound field amplification in response to this critique. A large volume of empirical data on the impact of SFA on individual language dimensions studied is presented in this study at two levels, the individual case study level and the class study level. The findings and the implications for policy and practice, based on this large empirical material, are presented with reference to this larger systemic perspective.

1.2.2 Innovation of Research Question

This research is innovative in a number of ways. Firstly, at a conceptual level, it proposes a systems theory framework to the study of SFA, a perspective that has been absent in previous international SFA literature, which was conceptualized predominantly in simple linearity between a causal antecedent and consequent. Secondly, in terms of research context, this research is unique in that it presents a first large-scale study on SFA in Ireland in mainstream schools.

Furthermore, it represents the first study internationally that is entirely concerned with the effect of SFA on language development of pupils in designated disadvantaged schools. Although the participants of previous SFA evaluations by Flexer & Long (2003), Heeney (2004) and McSporran et al. (1997) came from a mixed socio-economic background, no previous SFA studies to date focused on the potential benefits of SFA in areas designated as disadvantaged.

The exclusive focus on language in this thesis, extending into the study of a number of language dimensions, constitutes an important contribution in the context of SFA research to date. Previous SFA literature evidenced the benefits of this intervention for a number of academic dimensions, including such elements of language in the classroom as verbal participation, responsiveness, vocabulary and listening comprehension (Flexer, 2000; Heeney, 2004; Massie et al., 2004; McSporran et al., 1997; Osborn et al., 1989; Rubin et al., 2007). Teachers participating in previous SFA studies reported that this intervention supported communication in the classroom (Flexer, 1989; 1992; Heeney, 2004; McSporran et al., 1997; Osborn et al; 1989; Rosenberg et al., 1999). To date, however, no SFA study offered a more refined multidimensional notion of language by exploring which of its dimensions can be supported by this intervention.

An additional contribution of this study is made in terms of the size of its research sample, combined with a case study methodological approach. Case studies of 38 children from 8 different classrooms in 5 different schools were

analysed.[6] To date, classroom sound field amplification literature has presented either small size research (e.g., Crandell, 1996; Eriks-Brophy & Ayukawa, 2000; Flexer et al., 2002; Palmer, 1998) or has taken a cluster approach in an analysis of larger samples (e.g., Darai, 2000; Flexer, 1989, 1992; Heeney, 2004; Massie & Dillon, 2006a; Millet & Purcell, 2009; Osborn et al., 1989; Rosenberg et al., 1999; Rubin et al., 2007). Case studies of individual research participants have been analysed in more detail only by Palmer (1998) who investigated the effect of SFA on classroom behaviour of eight students in four American mainstream classrooms and by Eriks-Brophy & Ayukawa (2000) who observed the classroom on-task behaviour of seven Aboriginal students in Canada.

The utilization of a multiple baseline AB design to measure language gains in this study constitutes another contribution in the context of current SFA literature concerned with potential SFA benefits on language and literacy. Broadly defined academic achievement - comprising aspects relating to the communication in the classroom, as well as to language and literacy development - was previously studied in the SFA literature using predominantly standardised or diagnostic tests (Darai, 2000; Flexer, 1989; 1992; 2000; Heeney, 2004; Millet & Purcell, 2009). Prior to this research, only Massie & Dillon (2006a) utilised a within subject cross over AB design with SFA 'on' and 'off' to study the effect of SFA on academic achievement of children in 8 classrooms, while Rosenberg et al. (1999) utilised a single baseline AB design to study learning and listening behaviour in 64 experimental classrooms. The AB design adopted in the current SFA study allowed systematic observations of the system

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[6] There were 65 participants of the study from 14 classes of junior infant, senior infant and first class age level from 7 schools. The results for first classes, one senior infant class and one junior infant class were not presented in a case study format (see chapter three).

in which this intervention operates, thus contributing to the knowledge of what supports and strengthens the efficacy of SFA.

This study will investigate if SFA can bring benefits to language learning in the Irish early education classrooms. To date, a majority of previous SFA studies have taken place in an American context (Allen & Patton, 1990; Bradley & Sato, 2004; Crandell, 1996; Crandell & Bess, 1987; Darai, 2000; Flexer, 1989; 1992, 2000; Flexer et al., 2002; Jones et al., 1989; Larsen & Blair, 2008; Mendel et al., 2003; Ray, 1992; Rosenberg et al., 1999; Zabel & Taylor, 1993). As McSporran et al. (1997) observed, whole class teaching is the dominant method of instruction in American classrooms from an early age. The evidence from a UK context provided by McSporran et al. (1997) showed the benefits of SFA for students' listening and attending behaviours in situations other than whole class teaching. To date, however, no SFA studies replicated these findings in the UK or Irish early education context.

1.3 Outline of the Thesis

This thesis consists of six chapters. Chapter one includes the introduction and the following critical review of current SFA literature. Chapter two introduces a discussion on systems theory approaches applicable to education and to the understanding of SFA in the classroom. Chapter three presents the design of the research and research procedures, including a detailed description and a rationale for the use of nine language dimensions analysed in this thesis. Chapter four includes 38 case studies with graphs illustrating the observed changes in the studied language dimensions for each research participant,

together with a discussion on the observed intervening variables. Chapter five includes evidence regarding the observed class effect, while presenting the findings for each studied language dimension and for each participating class. Finally, chapter six presents a summary of key findings, the conclusion of the study, and its implications for further research, theory, policy and practice.

Review of Current SFA Literature

This section presents a review of previous studies on SFA categorised by focus on the observed benefits of this intervention for academic achievement, speech perception and pupil attending and listening behaviours in the classroom. The critical review of previous SFA studies will conclude with a summary of the contribution made by the current study.

1.4 Observed Benefits of SFA in Previous International Studies

A classroom sound field amplification system (SFA) consists of a microphone for the teacher and a system of loudspeakers mounted on the wall of the classroom. It amplifies and equalizes the teacher's voice in the classroom. While the use of SFA in regular classrooms has received increased international attention in the English speaking world in the last three decades, literature related to classroom SFA is still underdeveloped in Ireland, with no large-scale longitudinal SFA evaluation in mainstream schools to date. The following is a review of international English-language literature on SFA in regular classrooms. This review includes studies from American, Canadian, New

Zealandic, Australian and UK contexts. It mostly includes studies that appeared in peer-reviewed journals, as well as some early SFA evaluations. As Millet (2008) noted, some SFA evaluations cannot be sourced as they are unpublished, although they are quoted in some SFA research summaries. However, unpublished studies to which access could not be gained are not quoted in the review that follows.

SFA was originally used to support pupils with minimal hearing losses. Its benefits for children with normal hearing were discovered later. This thesis and the following literature review is not concerned with special education settings or pupils with special needs, including pupils with diagnoses of learning disabilities and/or hearing problems of various degrees. The large body of literature evidencing the benefits of SFA in special education settings is beyond the scope of this study.

Research on classroom amplification can be categorised by focus on the following areas - speech perception, classroom attention and listening behaviour, and more general academic performance including language and literacy development. While all peer-reviewed studies reviewed for the purpose of this thesis are included in the following discussion, an elaborate critical review of previous SFA studies presented in this chapter will focus predominantly on research that studied SFA benefits for academic performance.

Given that an early intervention is statistically more effective than one provided at a later age, most previous SFA studies evaluated its benefits for pre-school and early school populations (Eriks-Brophy & Ayukawa, 2000; Flexer et al., 1994; Flexer, 2002; Flexer & Long, 2003; McSporran et al., 1997; Palmer, 1998; Rubin et al., 2007). However, some reports cite SFA benefits for older

school populations (Ryan, 2009) and young adults (Larsen et al., 2008; Smaldino et al., 1997). Ryan (2009) found that the use of SFA could significantly reduce managerial time in middle school physical education classes. SFA was found by Larsen et al. (2008) to improve speech recognition of college pupils in both acoustically poor and acoustically sound classrooms and by Smaldino et al. (1997) to improve fine auditory discrimination of college pupils in a phonetics class. The following literature review of SFA studies includes only studies that focused on pre-school and early school populations.

The current study will address the gaps in the current SFA literature in terms of research context (disadvantage), research focus (language) and research conceptual framework (systems theory). SFA literature to date has claimed the benefits of this intervention for a number of diverse dimensions including listening and learning behaviour in the classroom (Rosenberg et al., 1999; Darai, 2000), reading literacy (Flexer, 2000; Heeney, 2004; Millet & Purcell, 2009), maths concepts and maths computation (Flexer, 1989; 1992; Ray, 1992), speech recognition (Bradley & Sato, 2004; Jones et al., 1989; Zabel & Taylor, 1993), on-task behaviour in the classroom (Allen & Patton, 1990; Eriks & Brophy & Ayukawa, 2000) and task management in the classroom (Palmer, 1998). Few studies, however, focused specifically on SFA benefits for language development and its multiple dimensions in the classroom.

Flexer (1989; 1992) and Ray (1992) found that vocabulary scores for first grade pupils and language and listening scores for kindergarten and first grade pupils, as measured with the use of the Iowa Test of Basic Skills in the first year of amplification, were higher in seventeen experimental classes than in their matched by age control ones. Flexer and Ray noted additionally an increased

classroom participation in the experimental classes following the installation of SFA. Claims for the positive impact of SFA on classroom communication emerged in the teacher reports in Flexer's (2000) and Darai's (2000) studies. Heeney (2004) claimed that the scores on listening comprehension, as measured by a standardised test (Progressive Achievement Test) were higher in the experimental classrooms than in their control ones. This finding was augmented by the teacher reports who cited increased understanding of instructions in the amplified classrooms (Heeney, 2004).

No previous SFA studies focused specifically on studying the efficacy of SFA for children in areas of socio-economic disadvantage. McSporran et al. (1997), Heeney (2004) and Flexer & Long (2003) studied children from mixed catchment areas, while Rosenberg et al. (1999) explored the benefits of SFA for children at risk of 'underachieving academically'. Children at risk of developing reading problems showed greater improvements in reading literacy in a study by Millet & Purcell (2009), while SFA was found to decrease the number of children with reading problems in a study by Flexer (2000). The findings of these authors were consistent with each other in that they showed that children with lower baselines and those from areas of socio-economic disadvantage showed greater improvements.

Furthermore, the majority of previous SFA studies did not take into account the context in which SFA operated, thus conceptualizing this intervention in the paradigm of simple linearity. This study will introduce a systems level focus on the efficacy of SFA on language development of children in designated disadvantaged schools in Ireland.

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1.4.1 Observed Benefits of SFA for Academic Performance

While significantly lowering the strain of listening, SFA enables better comprehension and thus 'faster learning' (Rosenberg et al., 1999) – a finding that led the first SFA researchers to studying its benefits for more general academic performance (Flexer, 1989, 1992; Flexer et al., 1994; Ray, 1989, 1992; Sarff et al., 1981). A three-year research project MARCS (Mainstream Amplification Regular Classroom Study) in Ohio (Flexer 1989, 1992; Ray, 1992) on lower elementary grade pupils compared 17 mainstream classes with sound-amplification systems with 17 control classes, matched by grade level, which did not have such systems. In the first year of the study, the classes with sound-amplification systems were found to have higher average scores than the control group on listening and language (for kindergarten and first grade classes), vocabulary (first grade), math concepts (second and third grade) and math computation (third grade), as assessed by an Iowa Test of Basic Skills. In the second year of the study, higher scores on the above dimensions, as compared to control groups, were found in three of the four grades (kindergarten, first and third grade). A general trend noted was that the younger the pupils, the greater the difference between the control and experimental group's achievement test scores. Classroom observations conducted by the authors of MARCS project indicated that the use of SFA increased the number of participating pupils, produced a more consistent rate of teacher speech and showed faster pupil transitions between activities. Teachers studied by Flexer (1989, 1992) reported also a reduction in vocal strain and vocal fatigue and an improvement in pupil attending skills.

The authors of MARCS project reported an increase in test results during

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the second year of the study for classes in three out of four experimental grade levels. However, they did not engage in discussion on the possible reasons why the difference between experimental classes of second grade was not significantly higher than the control classes of second grade, simply concluding that the overall difference between all experimental and control classes was statistically significant. Although the design of MARCS project was a combination of standardised tests (specifically the Iowa Test of Basic Skills), classroom observations of experimental classes and teacher reports, academic performance was assessed only by means of pre- and post-intervention standardised test administration. Individual characteristics of study participants, such as the baseline ability or the dynamics of each classroom, were not analysed. While the authors of the study observed the amplified classrooms, they did not report on classroom elements that might contribute to academic performance, such as, for instance, the quality of teaching or the size of the class.

The potential of SFA to accelerate learning was noted also in an American context by Rosenberg et al. (1999), who observed that children of kindergarten to second grade in amplified classrooms progressed academically at a faster rate than children in non-amplified classrooms, with their progress measured by checklists of listening and learning behaviours completed by their teachers. The authors of Rosenberg et al.'s (1999) study examined 64 experimental classes and 30 control classes, paired initially only by grade level but matched also by gender, otologic history (i.e. history of ear infections) and the percentage of minority pupils and pupils receiving specialised services. Thirty experimental classes were observed once pre-intervention and 4 times after SFA installation at

6, 12, 21 and 30 weeks of the intervention phase, and 34 classes were observed once pre-intervention and once 4 weeks after the installation of SFA.

The checklists of listening and learning behaviours were completed by the teachers for each pupil at the baseline, 6, 12, 21 and 30 weeks of the intervention phase. Teachers were asked to rate pupils in comparison to their peers. Findings indicated that pupils from experimental classrooms demonstrated significantly greater improvement in learning and listening behaviours and skills at all 4 observations in the intervention phase and improved at a faster rate than their peers from unamplified classrooms, with improvement greater for younger children. Kindergarten pupils in non-amplified classrooms showed the least amount of improvement.

The teachers participating in Rosenberg et al.'s study were asked to complete a classroom description worksheets designed to gather information about the classroom noise sources, classroom setting, classroom design, and 'the general information about classroom environment', such as the teaching style and the pupil characteristics. The details of the latter two aspects, namely the teaching style and the pupil characteristics, are, however, not reported on by the authors of the study. This information was averaged for all experimental and all control classrooms to provide overall information about classroom environment, rather than used to interpret findings for individual classes. Thus, while teaching style was recognised by Rosenberg et al. (1999) as an element of classroom environment that has some relevance to SFA, it was not elaborated on in relation to the findings of the study.

Darai (2000) studied the potential benefits of the classroom sound field amplification on the literacy growth of the students in an American mainstream

public school system. First grade pupils from eight classrooms from four different schools participated in her study. Experimental and control classrooms were selected on the basis of similarity of classroom ambient noise and 'teacher and principal compliance' (p. 1). Darai (2000) measured literacy growth with an Informal Reading Inventory (IRI), using reading instructional level at the middle and end of the school year. Teachers were additionally asked to complete the Teacher Appraisal of Listening Difficulty inventory of the Listening Inventory for Education that produced data on changes in attention, classroom participation and learning.

As a group, the pupils from the four amplified classroom achieved higher literacy scores when compared to their grade-peers from four unamplified classrooms. While a comparable number of experimental and control pupils advanced their literacy by 1 to 2 reading levels, a significantly larger number of experimental rather than control pupils advanced by as much as 7 reading levels (28 out of 85 compared to 13 out of 81). These findings indicate that SFA has a potential to accelerate academic performance for some pupils. Darai (2000), concurring with other SFA researchers, observed that the gains were greater for 'bilingual and special education pupils' (p. 2). She did not, however, engage in elaborated discussion on particular characteristics of the pupils who advanced by as much as 7 reading levels (including which classrooms they were from), a task that would potentially advance the knowledge on SFA. Darai (2000) additionally reports that the teachers in the experimental classrooms commented that SFA advanced phonics and language instruction in their classrooms. These claims are not further discussed in the study.

Other examples of SFA studies that demonstrated improved academic

performance of pupils in amplified classrooms include Flexer's (2000) study, which showed increased reading scores in first grade children from amplified classrooms. Flexer (2000) found that after just 7 months of SFA use, the percentage of first grade children from 3 amplified classrooms who passed a reading test increased by almost a half, in comparison to scores from five years previous to SFA installation (specifically, 74% of pupils achieved a basic level or above after SFA installation, compared to 44%-48% of pupils previously). The test used for the assessment of reading was The Core Curriculum Criterion Referenced Test (CCCRT)[7] that presents pupil results in four categories: below basic, basic, proficient and advanced. Flexer (2000) does not present more detailed information on this test, the methods of scoring and the specific tasks required.

Classroom teachers surveyed by Flexer (2000) reported that pupils in classes with SFA showed improvements in 'appropriate responses to questions as well as improved vocabulary and word usage skills' (p. 5). These teacher reports suggest that SFA contributed to some aspects of language development for children studied by Flexer (2000). These reports highlight, however, that the study of the claimed benefits of SFA on the students' language use in the classroom needs a more refined notion of language and the complexity of its dimensions. One must treat Flexer's findings with some caution as teachers of classes fitted with SFA might have been predisposed to look for benefits of SFA. This can be said also for Rosenberg et al.'s (1998) study (critiqued above) that measured children's performance with methods based on teacher judgment.

Heeney (2004) measured the impact of SFA on Aboriginal pupils from

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[7] Flexer (2000) reports that the CCCRT is routinely used by teachers in the Utah district where the study took place.

first to sixth school year in 30 amplified classrooms (compared to 12 unamplified ones) from five schools in Rotorua, New Zealand. Classes were matched by grade level, socioeconomic status of the school (i.e. school decile) and ethnicity of the pupils. A multi-method study design used Progressive Achievement Tests (PAT) (standardised tests group-administered to pupils), phonological awareness tests, a survey of teachers and feedback from pupils. Heeney (2004) found that pupils from experimental classes showed improvements in listening comprehension, reading comprehension and reading vocabulary as measured by PAT that were significantly larger than those of pupils from control classes. Furthermore, pupils from experimental classes showed significantly greater gains in phonological awareness (PA) skills on all ten sub-tests of PA, in comparison to control group.

Heeney (2004) also noted a statistically significant improvement of reading vocabulary skills in the control group, although a smaller one than in experimental classrooms. While there were no significant improvements on other dimensions in the control groups, and even deterioration on math performance, one might conclude that it was likely that some aspects of teaching contributed to gains in reading vocabulary skills in the control group, a possible explanation Heeney (2004) does not suggest.

Teachers participating in Heeney's study (2004) noted increased on-task behaviour, reduced disruptive behaviour and increased understanding of instructions in their classes after SFA installation. Furthermore, the gains in listening comprehension on PAT achieved by pupils in amplified classes tended to be greater in schools with a higher level of socio-economic disadvantage.[8]

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[8] Schools in New Zealand (where Heeney (2004) conducted his study) are attributed a decile

This finding must be however interpreted with some caution as only 5 schools participated in the study. Heeney's (2004) study presents thus some evidence that SFA can support the development in some aspects of receptive language. The norm-referenced tests used to assess pupil progress in this study were group-administered tests and were administered in the amplified classes by teachers using the microphones. Heeney's (2004) study lacks in discussion on whether increased comprehension scores in the amplified classes might have been attributed to increased intelligibility and audibility of a test instruction, rather than to some long-term benefits of SFA on language development.

Benefits of SFA for educational outcomes of pupils in Australian cross-cultural classrooms at second year (approximately 6-7 years old) were more recently studied by Massie and Dillon (2006a). Massie and Dillon's (2006a) study used a within-subject crossover design that used each experimental classroom as its own control, a methodological approach that is also taken in the present study. Pupils from eight classrooms participated in the study, with SFA 'on' and 'off' in each of them (SFA was switched on in 4 classrooms midway through the academic school year, while it was switched off in the other 4 classrooms that had it on from the start of the academic year), creating an AB design.

Diagnostic tests that included skill indicators for an appropriate grade on a developmental continuum of reading, writing and numeracy were administered by the teachers participating in the study by Massie and Dillon (2006a). Massie and Dillon reported significant acceleration in acquisition of these skills under SFA conditions, consolidating previous research findings that SFA can

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rating 1-10 that indicates their level of socio-economic disadvantage. Heeney (2004) observed that gains in listening comprehension tended to be higher in schools with lower decile rating.

contribute to accelerated learning. They concluded that SFA contributed to gains in areas of reading, writing and numeracy, as measured by diagnostic tests. SFA was observed to benefit both those children whose first language was English as well as those for whom English was an additional language (EAL).

Massie and Dillon's (2006a) study differs from other SFA studies in that a majority of its participants were EAL pupils. Participants of the study underwent hearing screenings pre- and post-intervention and acoustic qualities of the classes were measured (i.e. ambient noise levels, reverberation time and teacher speech levels). The authors of the study observed a strong underlying advantage for semester 1 in both amplified and unamplified classrooms (4 classes had SFA 'on' in semester 1 and 4 classes had SFA 'off' in semester 1), i.e. they observed that the skill increase, particularly in reading and writing, was greater in semester 1 than in semester 2 of the study. The authors note that this observation could have been related to the time of the assessment, specifically that the semester 1 assessment included learning that had occurred during the 6 week summer holiday (semester 1 included a time period since the end of year 1 to the middle of the year 2). It is recognised that these findings might require a different interpretation in areas designated as disadvantaged where some 'negative learning' might occur during the summer holidays (see, e.g., Cooper et al., 1996, for meta-analysis of studies).

The authors calculated mean skill increase for each semester for the time with amplification and the time without amplification. The result of this calculation was that the amplification was shown to produce a broadly similar increase in each semester, despite different skill increases for each semester, with the effect of SFA calculated as a simple deduction of the mean skill

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increase for each semester with amplification 'on' from the mean skill increase with amplification 'off'. This study takes a very linear cluster perspective to development when the authors report that 'the system effect per skill per semester (...) was one-third of the total number of skills acquired in each semester' (p. 72). Massie and Dillon note that one of the limitations of their study design was that the effect of SFA in classes that had the system 'on' in semester 1 could have been carried over to semester 2. Although not explicitly stated by the authors, this observation recognises that SFA has a potential to bring changes to the classroom dynamics that can last beyond the duration of the intervention.

A recent SFA study by Millet and Purcell (2009) examined the effect of SFA on reading outcomes in Canadian first grade classrooms. Twenty-four classrooms from 12 different schools participated in the study, 12 with amplification and 12 without amplification. The study utilised a quasi-experimental, non-equivalent group design (i.e. pupils were not randomly assigned to experimental and control classes) with experimental and control classes selected on the basis of geographical location and class size, with pre- and post- intervention Developmental Reading Assessment (DRA) administered by the teachers.

Findings indicated a greater percentage of pupils reading in the amplified classrooms after one year of amplification, as compared to no change outcome in unamplified classrooms. Furthermore, pupils from the amplified classrooms, who were identified in kindergarten as being at risk for developing reading difficulties, showed more improvement in reading level at the end of the year than their peers from unamplified classrooms. Specifically, the percentage of

pupils reading at grade level in amplified classrooms had increased by 5.3%, while the percentage of pupils reading at grade level had decreased in the unamplified classrooms by 6.7%. Both of these findings were trends and proved not to be statistically significant. This might suggest that SFA can support academic performance but its power is insufficient to bring about statistically significant changes in development (as measured by the DRA) in a relatively short term of one academic year. Additionally, SFA in this study was observed to support especially at risk pupils, and as the authors suggest, interventions with at risk groups might be expected to show smaller or slower effects, particularly over a course of just one academic year.

To summarise, SFA was claimed by previous SFA researchers to contribute to gains in the following dimensions: vocabulary, maths concepts and maths computation (Flexer, 1989, 1992; Ray, 1992), phonological awareness (Heeney, 2004), writing and numeracy (Massie & Dillon, 2006a), reading literacy (Darai, 2000; Massie & Dillon, 2006a; Millet & Purcell, 2009), reading comprehension and reading vocabulary (Heeney, 2004), learning and listening behaviour in the classroom (Darai, 2000; Flexer, 1989, 1992; Ray, 1992; Rosenberg et al., 1999) and listening comprehension (Heeney, 2004). As these dimensions represent a diverse set of skills, one can conclude that SFA has the potential to accelerate the learning in the classroom in general.

One of the methodological limitations of previous SFA studies concerned with the effect of this intervention on broadly defined academic achievement is that they have adopted almost exclusively a cluster approach in an analysis of their findings (Darai, 2000; Flexer, 1989, 1992, 2000; Heeney, 2004; Massie & Dillon, 2006a; Millet & Purcell, 2009; Ray, 1992; Rosenberg et al., 1999). Only

Massie & Dillon (2006a) analysed the outcomes of this intervention on individual classrooms, while no studies reviewed above adopted a case study approach.

Another methodological weakness of SFA literature to date is that academic achievement, including such dimensions as phonological awareness, vocabulary and listening comprehension, was studied by SFA researchers predominantly through the administration of pre- and post-intervention standardised or diagnostic tests (Flexer, 1989; 1992; 2000; Heeney, 2004; Millet & Purcell, 2009). Measurement of competence from more than a single time performance was implemented only by Massie & Dillon (2006a) and Rosenberg et al. (1999). Massie & Dillon (2006a) utilised a within subject cross over AB design with SFA 'on' and 'off' to study the effect of SFA on academic achievement of children in 8 classrooms. Rosenberg et al. (1999) utilised an AB design to study learning and listening behaviour in 64 experimental classrooms, with 4 observations in the intervention phase, however using only a single observation at baseline in each class. The following section will summarise SFA studies that investigated the effect of this intervention on speech perception in the classroom.

1.4.2 Observed Benefits of SFA for Speech Perception

A recent SFA study by Larsen and Blair (2008) measured speech and noise levels in four mainstream American fourth grade classrooms and found that the recommended signal-to-noise ratio level of between +12dB to +15dB was achieved only with amplification (at +13dB above the noise floor, compared to an average of +2dB above the noise floor without amplification). The authors

measured the floor noise levels, mean child group noise, mean teacher speech level and the signal-to-noise ratio (SNR) of teacher to child group noise level at nine different occasions in each of the four participating classrooms. Without the amplification, the SNR of teacher to child noise level was below the recommended level during all classroom situations recorded by the authors of the study.

Researchers found that speech intelligibility in the classroom decreases with the increase of background noise (Bradley & Sato, 2004; see Rosenberg et al., 1995, for a review). In the Bradley and Sato (2004) study, children of six, eight and eleven years old in mainstream American classrooms were asked to complete a speech recognition test, specifically the Word Intelligibility by Picture Identification (WIPI) test, with increased and decreased background noise. The authors found that the younger children needed an increased signal-to-noise ratio in order to achieve the same intelligibility as the older children. While the authors of the study noted high variability among children in the test results, they concluded that the observed age effect means all pupils could do well in favourable acoustical classroom conditions, although some did not due to poor classroom acoustics.

Similar conclusions were reached by early SFA researchers in America who evaluated speech perception in increased signal-to-noise ratio with the use of SFA (Jones et al., 1989; Zabel & Taylor, 1993). When the voice of the teacher was amplified via SFA, kindergarten children scored better on word recognition-tasks and primary school aged children scored better on spelling tests (specifically, the Curriculum-Based Measurement test of spelling) than children who listened to instructions in non-amplified classrooms (Jones et al., 1989;

Zabel & Taylor, 1993).

SFA was also found to improve speech recognition scores for EAL pupils in mainstream American classrooms (Crandell, 1996). Crandell (1996) administered tests of monosyllabic word recognition to 20 EAL students who were native Spanish speakers at three speaker listener distances, 6, 12 and 24 feet, in both amplified and unamplified conditions. Results indicated that speech perception scores were significantly higher in the amplified conditions for both 12 feet and 24 feet speaker listener distances as compared to scores in the unamplified conditions. Furthermore, speech perception scores under amplified conditions were essentially constant across each speaker-listener distance.

Good speech intelligibility as a potentially crucial aspect in phonemic awareness acquisition was highlighted further in a study by Flexer et al. (2002), who measured phonemic awareness skills of kindergarten children from three classrooms, one with regular curriculum, one with additional phonological and phonemic awareness training and one with additional phonological and phonemic awareness training *and* classroom sound field amplification.[9] Phonemic awareness is a conscious awareness that individual words consist of individual speech sounds (Walsh, 2009). It can be measured by a variety of diverse tasks, most commonly, by phoneme identification (of initial, medial or final sounds in words), phoneme segmentation (i.e. by segmenting words into sounds) or phoneme deletion (e.g., in tasks of a type *what is crocodile without a dile*) (Semel et al., 2003). Phonemic awareness is considered to be a component of a larger set of skills termed phonological awareness skills which include an ability to reflect on both isolated speech sounds as well as on larger units of

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[9] The additional phonological and phonemic awareness instruction was delivered in a direct group teaching 15-minute lesson 4 times a week for a period of one academic year. The authors of the study do not elaborate on the size of the group and the specific content of this instruction.

speech structure such as syllables and rhymes. There is a large body of literature supporting a link between phonemic awareness skills and literacy acquisition (see Gillon, 2004, for a review).

The scores of children in both classes with additional instruction were significantly higher than the scores of the pupils in the class without additional instruction. However, Flexer et al. (2002) also observed that children in the amplified classroom tended to be more phonemically aware than their peers from two unamplified classrooms (as measured using a diagnostic test of phonemic segmentation), and concluded that SFA has a potential to improve the effectiveness of phonemic awareness instruction. One may conclude from the evidence presented by Flexer et al.'s (2002) study that phonemic awareness may be more effectively taught in pre-school classrooms that are supported by SFA, although the study findings need to be interpreted with much caution due to a very small study sample and the measurement of only one aspect of phonemic awareness (i.e. phoneme segmentation).

The authors of Flexer et al.'s (2002) study note that while the differences in scores between the two classes that received additional instruction were not statistically significant, there was a tendency for higher scores in the class fitted with SFA. Moreover, there was a lower percentage of pupils whose scores were at the lower end, indicating that a child may still be at risk of reading problems in the amplified class (9% compared to 43% in the class with only additional instruction and 57% in the control group). The authors do not cite the relevant baseline percentages. However, they found that the standard deviation (SD) of the amplified group was lower than the SD of the other two groups, indicating more homogeneity in the group performance, i.e. less variation in the scores of

individual pupils. The latter finding, namely that there was a lower percentage of pupils at risk of reading problems in the amplified class, concurs with previous studies evidencing that SFA can support the learning of pupils at risk of 'underachieving academically' (Rosenberg et al., 1999; McSporran et al., 1997), thus providing 'a more consistent positive effect across the whole group' (Flexer et al., 2002, p. 44).

The teachers of Flexer et al.'s study who taught in classes that received additional training attended three sessions of in-service education on phonological and phonemic awareness. Based on a large body of literature supporting the link between teachers' knowledge and pupils' learning, one might have anticipated that the scores would be higher in classes with these teachers. The authors of the study did not engage in observations of individual classes, a significant methodological limitation of the study, whose findings are based on only one amplified class. However, they mention that all three teachers participating in the study, i.e. in both the amplified and non-amplified classrooms, received a 'favourable' performance rating on the performance evaluation system used in pre-school education in the geographical district where the study took place.

Similar conclusions, namely that SFA can support pupils in developing phonological awareness, were reached by Heeney (2004), who found that Aboriginal pupils taught in 30 amplified classrooms in New Zealand achieved significantly higher scores on phonological awareness skills tasks than their controls in 12 unamplified classrooms. Heeney (2004) found that as a group, the pupils from the experimental classes showed significantly larger improvements on all ten subtests of the test than their peers from the control classes. Coupled

with the knowledge of the now well-established link between phonological awareness and literacy (Gillon, 2004), this finding may be of particular importance to schools in areas designated as disadvantaged where a higher number of pupils experience literacy difficulties (Eivers et al., 2004).

Speech recognition scores, measured using a within subject ABAB design, were found to increase in amplified conditions for both those children for whom English was their first language (Crandell & Bess, 1987; Jones et al., 1989) and for EAL children (Spanish speaking) in American mainstream classrooms (Crandell, 1996). The effect of SFA on speech perception was first longitudinally measured by Mendel et al. (2003), who observed speech perception of kindergarten children in American mainstream classrooms over a 2 year period in both amplified and non-amplified classrooms. Ninety-five children who were randomly assigned to one of three amplified classrooms participated throughout the duration of the two-year study. Three unamplified classrooms were selected as control groups, based on similarity of size, shape and acoustic parameters. Mendel et al. (2003) utilised a unique study design, comparing performance of participants across treatment and control groups longitudinally. The results of this controlled study show that while speech perception, measured using word recognition and word intelligibility by picture identification[10], was better after 2 years of observations in the amplified classes, this was *only* true when the teachers administered tasks actually wearing the microphones.

Moreover, better scores under SFA were only present for kindergarten children, i.e. by the time children reached first grade (i.e. approximately 6 years

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[10] Two tests were used: Phonetically Balanced Kindergarten (PB-K) word lists and The Word Intelligibility by Picture Identification (WIPI) test. The WIPI test was also used in the SFA study by Bradley & Sato (2003) described above.

of age), they performed similarly on speech perception tasks with or without amplification. The differences between experimental and control groups at the end of the 2 year study were not significant if the teachers did not wear the microphones for the task administration. Interestingly, while speech perception of children in the amplified conditions improved sooner, children from control groups were able 'to catch up' by the end of the second year. In other words, after 2 years of SFA use, the scores on speech perception tasks achieved by the pupils in the experimental classes did not significantly differ from those achieved by the pupils in the control classes.

Mendel et al. (2003) conclude that SFA can be a significant contributor to speech perception performance for kindergarten and first grade children, giving the children 'a head start' and enabling them to excel quicker than children in non-amplified classrooms. However, they add that SFA benefits for speech perception are immediate and that while 'long-term use of SFA is not harmful (...) it is possible that the benefits may plateau over time' (Mendel et al., 2003, p. 122). This conclusion implies no necessity for long-term SFA exposure. Speech is, however, not a focus of the current study. One might hypothesise that, as opposed to speech perception benefits, children might need a long-term SFA exposure for language benefits.

1.4.3 Observed Benefits of SFA for Pupil Attending and Listening Behaviours in the Classroom

The following accounts will focus on studies that investigated the effect of SFA on on-task and listening behaviour in the classroom. Attention plays a fundamental role in language processing (Conner et al, 2000). Previous SFA

studies provided the evidence that children who were reported by their teachers to be more attentive and more on-task after the SFA installation also had better responsiveness (Eriks-Brophy & Ayukawa, 2000), higher classroom participation (McSporran et al., 1997) and increased understanding of instructions (Heeney, 2004).

SFA studies on attention and listening behaviours represent more ecologically valid research than the SFA studies on academic achievement. While academic performance and language in SFA literature were often studied using standardised tests or more often diagnostic tests based on teachers' judgement (Darai, 2000; Flexer 1989, 1992, 2000; Heeney, 2004; Massie & Dillon, 2006a; Millet & Purcell, 2009; Ray, 1992), the benefits of SFA for attention and classroom behaviour were measured frequently by classroom observations with multiple baseline designs (Allen & Patton, 1990; Eriks-Brophy & Ayukawa, 2000; Gilman & Danzer, 1989; Maag & Anderson, 2006; 2007; Palmer, 1998; Ryan, 2009). Classroom observations represent ecologically valid research methods as they measure behaviour in its naturalistic setting, at the same time putting a greater emphasis on the context of the intervention. The current study will utilize classroom observations to measure the effect of SFA on language performance.

The benefits of SFA on on-task behaviour were measured in an American context by Allen and Patton (1990), using a within-subject research design. Allen and Patton used a systematic observations protocol to study on-task behaviour of 122 randomly selected normal-hearing first and second grade pupils and found that sound-amplified classes produced pupils who were more attentive, less distractible and in need of fewer repetitions by the teacher – with a

17% increase in on-task behaviour when the amplification was available. On-task behaviour under amplified conditions improved also in Aboriginal children studied by Eriks-Brophy and Ayukawa (2000). Teachers in this SFA evaluation conducted among Inuit community in Canada, where 26% of pupils participating in the study had some degree of hearing loss, reported that children were more attentive, more responsive and more on-task with sound field amplification. The authors also found that SFA supported better speech intelligibility, as measured by speech discrimination-tasks of Inuttitut[11] syllables, in both pupils with baseline hearing problems and those with normal hearing (twenty pupils, 10 with hearing difficulties and 10 age-matched pupils with normal hearing were asked to repeat syllables played from a tape recorder with SFA 'on' and 'off'). A significant limitation of Eriks-Brophy and Ayukawa's (2000) study is its relatively small sample. While 3 amplified classes participated in the study (grade 2 class, i.e. 7-8 years olds, grade 3 class, i.e. 8-9 years olds, and a third secondary multi-level class of Inuit adolescents aged 13-17), only 20 pupils were randomly selected for the speech intelligibility test and only 7 children, also randomly selected, were observed in the classroom.

The SFA evaluation of Eriks-Brophy and Ayukawa (2000) cannot be generalized to other populations as the Inuit population is characterised by two unique characteristics, namely very high prevalence of otitis media (i.e. fluctuating hearing difficulties) and classroom interaction often conducted by a team consisting of a teacher and a teacher assistant who encourage peer talk and physical contact between the pupils (Brophy & Ayukawa, 2000). Despite a small sample and the uniqueness of the studied population, the findings of this study

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[11] Inuttitut was a native language of the study participants.

are important for the discussion of this thesis. Observations were conducted for 15 minutes pre-intervention and for 15 minutes 3 months after SFA installation in 60 intervals of 15 seconds each. While all 7 pupils demonstrated improvement in at least one category of attending behaviours, on-task behaviour of 1 pupil out of the 7 pupils observed *decreased* following SFA installation. The authors of the study additionally note that data from individual pupils' profiles show different patterns of attending behaviours, both before and after SFA installation. They do not, however, engage in a discussion on other possible factors affecting classroom performance and argue that 'the failure to obtain significant differences in all four attending behaviours for all pupils in the amplified versus unamplified condition' (p. 333) might have been due to the observation instrument.

In contrast to SFA studies on academic achievement and speech perception, SFA studies on classroom attending and listening behaviours extend into the UK context. Previous SFA studies on academic achievement and speech perception are largely from an American context (Bradley & Sato, 2004; Crandell, 1996; Crandell & Bess, 1987; Darai, 2000; Flexer, 1989; 1992, 2000; Flexer et al., 2002; Jones et al., 1989; Larsen & Blair, 2008; Mendel et al., 2003; Ray, 1992; Rosenberg et al., 1999; Zabel & Taylor, 1993), however they include also studies from Canada (Millet & Purcell, 2009), Australia (Massie & Dillon, 2006a) and studies on Aboriginal students in New Zealand (Heeney, 2004). SFA studies on classroom attending and listening behaviours include research by McSporran et al. *(1997) who provided evidence supporting the efficacy of SFA* in the UK classrooms.

McSporran et al. (1997) piloted the use of SFA in two UK regular year three classrooms (i.e. approximately 8 years old). One class was selected for the study due to its high reverberation time and the second class was selected because 40% of pupils in it were EAL pupils. While the two classes studied by McSporran et al. (1997) were regular mixed catchment area schools, the authors found that 10 children in the first class and 15 children in the second class could have been at risk of 'academic underachievement'. This conclusion was reached on the basis of a screening instrument called the SIFTER (Screening Instrument for Targeting Education Risk), which observes such behaviour as attention, class participation, academic performance, school behaviour and communication. The 25 children who were considered at risk of 'educational underachievement' participated in the study.

The authors of McSporran et al.'s research (1997) studied listening behaviour of children pre- and post- SFA installation. The participants' listening behaviour was assessed by classroom teachers using the Children's Auditory Processing Performance Scale (CHAPPS) pre-intervention and after 5 months of SFA use. CHAPPS is a checklist of listening and attending behaviours, which compare the child to his/her class peers pre-intervention. The results showed that the scores of a significant majority of participants (i.e. the target pupils) increased. The authors noted that improvements tended to be greater for children with lower baseline scores and greater for children whose first language was not English. The findings of McSporran et al.'s (1997) study are significant in that they present first evidence for SFA benefits in UK classrooms as opposed to American classrooms, where the majority of SFA studies have taken place. As McSporran et al. (1997) note, UK classrooms differ in teaching methodologies

from the American classrooms in that the whole class format is the dominant teaching method in US classrooms from the early years.

The authors of a recent Canadian study on SFA studied 60 classrooms from kindergarten to third grade, 31 amplified and 29 non-amplified ones (Rubin, Flagg-Williams & Aquino-Russell, 2007). Experimental and control classes were matched on pupil enrolment figures according to geographical district, age, number of pupils in the class and language of instruction (i.e. either English or French). Methodology included hearing assessments, measurement of acoustic quality of classrooms[12], classroom observations and semi-structured interviews with pupils and teachers from the amplified classrooms at the end of the study. Each pupil was observed 4 times for a period of 30 seconds during Language Arts lessons at the start and at the end of the study, using a systematic observation protocol – the Revised Environmental Communication Profile (RECP) (Massie et al., 1999).[13] Data for all pupils from amplified classrooms and all pupils from unamplified classrooms were averaged.

Rubin et al. (2007) found that as a group the pupils in 31 amplified classrooms responded to the teacher more frequently than the pupils in 29 non-amplified classrooms, with statistically significant difference between the amplified and the non-amplified classes. This was measured as the percentage of pupils responding to the teacher after being addressed to by the teacher (see footnote 13 below) and was found for all ages, i.e. kindergarten to grade 3.

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[12] Acoustic quality of classrooms was estimated based on a combination of the level of ambient noise and the reverberation time.
[13] The RECP quantifies verbal contributions and nonverbal responses of the pupils in the class, including the number and frequency of contributions and the direction of contributions (i.e. to the teacher or to the pupil). Specifically, the RECP allows observers to record three types of interaction: the teacher initiating communicative interaction to the observed pupil, the teacher initiating communicative interaction to the whole class and the teacher initiating communicative interaction to the peer of the observed pupil (i.e. to another pupil), where communicative interactions meant talking, touching, gesturing or making eye contact.

The authors of Rubin et al.'s (2007) study also found that pupils in the amplified classrooms initiated fewer communicative interactions to their peers while the teachers were speaking than pupils in non-amplified classrooms (specifically, pupils' initiations to the peer decreased when the teacher's whole class statements increased). This is an interesting finding suggesting, according to the authors of the study, that the pupils in the amplified classrooms could hear the teachers better and were thus more engaged in listening. While the authors of the study do not report on the format of the observed lessons, which is a limitation of their study, interpretation of this finding suggests that whole class authoritarian teaching was a dominant teaching mode. The authors of the study seem to attribute a positive value to a decrease in pupils' initiations, an assumption that cannot be critiqued here due to the absence of more in-depth analyses of individual classrooms and lessons, specifically the lesson format and the content of teacher and pupil contributions during observations. Most early education researchers would, however, view a decrease in pupil interactions as a negative outcome. One can thus conclude that this finding shows a rather unfavourable effect of SFA in early childhood education settings.

The observations of Rubin and colleagues did not record lesson type and lesson content, nor did they record the content and purposes of pupil initiations, and the authors do not elaborate on whether the teachers taught more frequently in whole class format after SFA installation. Furthermore, while the authors do not record the format of the lessons, they interpret the findings with assumptions underlying whole class teaching, i.e. they interpret decreased pupil initiations versus increased teacher talking as a positive outcome of the intervention, implying listening as a more positive behaviour than communicative interaction.

Contrary to Rubin et al. (2007), however, Massie et al. (2004) found that Aboriginal children were more proactive in peer-to-peer discussions under the amplified conditions. The peer-to-peer interactions and classroom participation level of pupils may perhaps depend on the studied culture as well as on the teaching style, observed teaching mode (i.e. whole class versus group work) and a number of factors specific to individual classes. One of the limitations of the study by Rubin et al. (2007) is that in its proportions of teachers' and pupils' communicative behaviours, i.e. the frequency and direction of communication, it averaged from all amplified and all unamplified classes studied, without accounting for variations in each classroom's microsystemic elements. Data were recorded by a number of research assistants using a relatively complex instrument for recording communicative interactions (communicative interaction was defined as either talking, gesturing, touching or making eye contact with another peer or teacher) and no inter-researcher agreement was measured. Teachers participating in Rubin et al.'s (2007) study noted less voice strain while teaching with SFA, a benefit of SFA that consistently appears in literature (Sarff et al., 1981; Flexer, 2002; Massie et al., 2006b; McSporran et al., 1997).

Elsewhere, Flexer and Long (2003) found that an increased signal-to-noise ratio has a potential to decrease the number of special education referrals from regular classrooms fitted with SFA. They noted that in a school in which all classrooms from kindergarten to fifth grade were amplified, after just 8 months of SFA use, special education referrals decreased by almost half as compared to the previous 9 years. As the referrals encompassed all categories of special education, including occupational therapy, physical therapy, vision services and hearing services, no causal conclusions could be made. Types of special

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education referral and the numbers of children in each category were not analysed in the study, a limitation that is recognised by the authors of the study. However, the authors note that a clear trend for a decrease in special education referrals could be observed. Similar conclusions were reached by the authors of one of the first studies on SFA, the MARCS Project Studies 1979-1993 (Flexer, 1989; 1992; Ray, 1992), which found almost a 40% decrease in special education referrals (averaged across all categories of special needs) after 5 years of SFA use. These potentially significant findings highlight further the importance of a link between hearing and learning.

1.4.4 Contribution of the Current Study

The limitations of previous SFA studies can be classified in areas of research context, research methods and conceptual approaches adopted by their authors. This section will discuss the contribution of the current study to each of these areas. While benefits of SFA have been studied for various cultures, many international SFA researchers focused on Aboriginal cultures (in Canada: Eriks-Brophy & Ayukawa, 1999; 2000; in America: Flexer (2000); in New Zealand: Heeney (2004); in Australia: Massie et al., 2004; Massie & Dillon, 2006a; 2006b) as Aboriginal cultures are reported to have very high incidence of hearing problems, including otitis media[14] (Eriks-Brophy & Ayukawa, 1999; 2000; Massie et al., 2004). SFA benefits have not been studied previous to this report for children living in areas designated as disadvantaged, either in Ireland or internationally, although some at-risk pupils who benefited from this

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[14] In Eriks-Brophy and Ayukawa (2000) study, 26% of children assessed at baseline had hearing problems due to otitis media.

intervention in previous SFA evaluations came from areas of socio-economic disadvantage.[15]

The review of the literature presented above revealed that SFA has a potential to be especially beneficial for children from disadvantaged backgrounds (Heeney, 2004; McSporran et al., 1997; Millet & Purcell, 2009; Palmer, 1998). Heeney (2004) noted that pupils in schools with a lower socio-economic status showed greater improvements in reading than the other pupils from experimental schools. Pupils identified by their teachers as being at risk of reading difficulties at the start of the school showed also greater improvements in reading than the other participants in an SFA study by Millet & Purcell (2009). Palmer (1998) and McSporran et al. (1997) demonstrated SFA benefits for children at risk for 'underachieving academically' as identified on the basis of SIFTER (Screening Instrument for Targeting Education Risk), which observes such behaviours as attention, class participation, academic performance, school behaviour and communication. Furthermore, children with lower baselines participating in McSporran et al.'s (1997) study showed a tendency to show greater improvement in listening skills than children with stronger baselines.

While the benefits of SFA for more general academic performance are well evidenced in literature, its specific benefits for language development have not been studied in great detail, i.e. with inclusion of an array of language dimensions.[16] Most previous SFA studies examined single language dimensions or a couple of dimensions (Flexer, 1989, 1992; Flexer et al. 2002, Eriks-Brophy

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[15] The children studied by McSporran et al. (1997) came from mixed catchment area; 33% and 43% of pupils from two classrooms studied respectively, were identified by the authors as 'at risk of educational underachievement'. Also, participants in studies by Flexer and Long (2003) and Heeney (2004) came from a mixed socio-economic background.

[16] The rationale for selecting language dimensions will be presented in chapter three.

& Ayukawa, 2000; Heeney, 2004; Ray, 1992; Rubin et al., 2007). More importantly, language has not been studied in relation to SFA in an AB design, presented in this thesis. Academic achievement in SFA literature has been examined previous to this study using predominantly diagnostic or standardised tests and/or teacher judgment based assessments (Flexer, 1989, 1992; 2000; Heeney; 2004; Millet & Purcell, 2009; Ray, 1992). One must recognise that the teachers in the experimental classrooms might have been predisposed to report on SFA benefits. Rosenberg et al. (1999) who utilised an AB design in their SFA evaluation measured the baseline learning and listening behaviour of the study participants in only one single observation (they recorded four observations after the SFA installation). Furthermore, no SFA studies on academic achievement adopted a case study approach.

A majority of SFA evaluations to date seem to be conceptually rooted in linear causality, i.e. they assume that the outcome of the intervention can be predicted on the basis of one-antecedent-one-consequence linearity. Such thinking does not take into account the characteristics of a system in which the intervention operates. The application of systems theory to the SFA evaluation, presented in this thesis, has a potential to represent a better account of this intervention, presenting the view of education as a complex non-equilibrium system and as such developing in ways more complex than single linear ones.

While Palmer (1998) and Mendel et al. (2003) acknowledged the importance of context in their studies on the benefits of SFA, a significant majority of other reports to date on SFA follow the traditional dichotomy of cause-effect relationship and present the impact of this intervention on single dimensions, e.g. on classroom responsiveness, without considering other

systemic parts and the interaction between them (including Allen & Patton, 1990; Bradley & Sato, 2004; Eriks-Brophy & Ayukawa, 2000; Flexer et al., 1994; Jones et al., 1989; Massie & Dillon, 2006a; 2006b; McSporran et al., 1997; Rubin et al., 2007 and Sarff et al., 1980). System theorists (Foster-Fisher & Behrens, 2007; Hardy, 2001) argue that such a traditional model of causation (i.e. that x causes y) is inadequate to deal with the complexities of social settings and indeed the world at large. Systems theory allows for methodological attention to the complexities of the classroom, thus enhancing the knowledge on the efficacy of interventions introduced into it.

Most of the previous SFA evaluations did not take into account the context in which they occurred, such as the classroom structure or the teaching methodologies, which should be a standard practice in intervention studies. This is both a conceptual and a methodological limitation. Palmer's (1998) study is the only found SFA study that applied an ecological perspective to the evaluation of SFA benefits. Palmer observed classroom behaviour of 8 pupils in interaction with their contexts, i.e. activity type, task type, classroom structure (e.g., group versus individual work), teacher's position and teacher's behaviour. She found that SFA immediately reduced inappropriate behaviours and improved task management in 8 pupils from 4 different classrooms, observed in a single subject ABA design, who were identified by their teachers to be at risk for 'educational underachievement'. Inappropriate behaviour increased immediately after the withdrawal of SFA, while improved task management was maintained.

Palmer (1998) found that the teacher's positions and the teacher's behaviour did not change after SFA installation, thus concluding that, in the

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absence of the teacher effect, SFA was the main contributor to the observed changes. Although the observations of students' behaviours in the classroom were supplemented by recording of the task type, the activity type and the classroom structure, a cluster approach to the analysis of these findings was adopted. In other words, the baseline and the intervention data on these three aspects of the classroom system were compared to each other, and no substantial differences between them were concluded. Thus, while an ecological approach is present in Palmer's design of the study, her conclusion on the efficacy of SFA follows the simple linearity of other SFA researchers and does not add to the understanding of the SFA efficacy.

The influence of context on the efficacy of SFA was acknowledged also by Mendel et al. (2003) who measured the effects of SFA on speech perception by longitudinally observing children in 7 amplified and 7 non-amplified classrooms. Mendel et al. noted that one experimental class participating in their SFA study showed a significantly larger improvement in reading than the other experimental classrooms. They concluded that teacher variability was a potential factor that had an influence on the results of their study and that it was 'difficult to control'. Rather than 'control' it, however, it may prove interesting to observe it closely and analyse it together with the pupils' performances, an approach that was taken in this thesis. Mendel et al. engaged in no further discussion on the implications of their findings on conceptualising SFA as an educational intervention.

The claim of the importance of context in which SFA is operating emerged also in two other SFA studies by Rosenberg et al. (1999) and Eriks-Brophy & Ayukawa (2000). Teachers participating in Rosenberg et al.'s (1999)

study were asked to complete questionnaires on classroom properties, student characteristics and teaching approaches. This potentially informative data was unfortunately not used to interpret research findings, only merely to compare the baseline to the intervention data. Finally, Eriks-Brophy & Ayukawa (2000) who observed the effect of SFA on on-task behaviour of seven children found that one pupil's on-task behaviour deteriorated in the intervention phase. Their conclusion on the efficacy of SFA is not, however, qualified by this finding. The systemic approach, introduced in this thesis for the first time to the interpretation of SFA, is largely elaborated on in the current study.

These aforementioned methodological limitations of previous SFA studies precluded their authors from gaining an insight into the working of this intervention in a naturalistic setting. Thus, most SFA efficacy studies are positioned in stark contrast to the current model of intervention efficacy studies that conceptualise interventions in context. Hayes (2004) notes that in early education research, simple input-output approaches to evaluating intervention efficacy have been replaced by studies following more contextual models of development already in the 1980s. An assessment of language in real life interactions is needed in order to assess the context for language development. The current study will utilize both standardised tests of language as well as language assessment contextualized in a naturalistic environment.

It is important that research methodology permits results that are very different to the original hypothesis. Bronfenbrenner already (1979) highlighted that 'the experiment is a powerful and heuristic tool' (p. 20). Hence, a part of the methodology of this thesis is the focus on analysis of the environments and the situations when SFA is *not* working, to uncover further truths and not only to

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prove the hypothesis. This constitutes another novelty in the context of research to date on this topic.

Despite a plethora of research on SFA, literature on it seems to be as yet underdeveloped. A large number of SFA studies are small-scale research projects, utilising simple linear analysis in their attempt to present the 'benefits' of SFA. Recent researchers of SFA recognise that 'more research concerning classroom amplification is needed to understand its limitations and strengths so that it can be used appropriately for the benefit of pupils' (Larsen & Blair, 2008, p. 451). This thesis attempts to augment the understanding of the efficacy of SFA by conceptualising it within the systems theory model. Previous SFA studies have conceptualized SFA in a paradigm of simple causality of one antecedent and one consequence/outcome. This thesis extends this paradigm into one of complex causality. In other words, while the efficacy of SFA was studied for the purposes of this thesis using the empirical model of AB design consistent with behaviourism, the system of the classroom was observed in terms of the conditions it created for this intervention.

1.5 Language and Literacy Difficulties of Children in DEIS (2005) Schools

Benefits of SFA have been studied for various groups of vulnerable children. Rosenberg and Blake-Rahter (1995) cite a range of literature highlighting SFA benefits for at risk children including those with articulation disorders, speech and language delays, developmental delays and central auditory processing (CAP) disorder, as well as children for whom English is a second language (ESL) and children with normal hearing who need to develop

listening and academic skills (p. 168). Moreover, Crandell et al. (1995) emphasised the particular advantages of SFA for children experiencing hearing problems and/or attention and behaviour difficulties, as well as children for whom English is an additional language. Elsewhere, McSporran et al. (1997) reiterate that SFA should be evaluated for at risk populations, including those with language and learning difficulties, as well as those at risk for 'underachieving academically'.

There is some evidence that there is a higher number of children at risk for academic underachievement in areas designated as disadvantaged. Literacy standards among children and young people living in areas designated as disadvantaged in Ireland are a cause for concern (Cosgrove et al., 2000; DES, 2005a, 2010b; Eivers et al., 2004). Eivers et al. (2004), who studied reading achievement of children in first, third and sixth classes in designated disadvantaged schools in Ireland, reported that the reading literacy scores of between 27 and 30 per cent of children participating in their study were at or below the tenth percentile. Recent results of the Programme for International Student Assessment (PISA) (2009) in reading showed that the decline in reading standards in Ireland from 2000, when reading was also a major assessment domain of PISA, and 2009 was the largest across all thirty nine countries participating (Perkins et al., 2010).[17] This decline was reported across all ability levels. Literacy difficulties are associated with early school leaving (Oireachtas Joint Committee on Education and Skills, 2010), low-paid employment, unemployment and involvement with crime (Morgan et al., 1997).

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[17] Perkins et al. (2010), the authors of the Irish summary report on PISA, recognise two possible interpretations of this decline in the Irish context. The first interpretation indicates that the reported decline reflects the real decline in the students' knowledge and skills, while the second interpretation suggests that the results were affected by the factors associated with the administration of PISA in 2009 and/or linking of the data from one administration to another.

It is likely that alarming literacy standards among children from designated disadvantaged schools in Ireland (Cosgrove et al., 2000; DES, 2010b; Eivers et al., 2004; IDES, 2005) may be partly attributable to language skills. The interrelationship of language and literacy has been emphasised by several researchers (Chaney, 2000; Cregan, 2006; Lorch et al., 2007; Snow et al., 1998; Whitehurst, 1997) and subsequently acknowledged by the English curriculum in Ireland (DES/NCCA, 1999). The existence of a link between language and literacy has been recognised in a recent DES report on literacy and numeracy (DES, 2010b), which proposes a draft national plan to improve literacy and numeracy outcomes in Irish schools. It recognises that the knowledge on language acquisition as well as on the structure and function of oral and written language should constitute a crucial aspect of teacher education. Furthermore, it recommends that formal skills in language development should become a requirement for early childhood practitioners, and places particular emphasis on the development of oral language skills in pre-school settings that feed into DEIS Band 1 schools. These recommendations recognise that children from areas of socio-economic disadvantage in Ireland may experience language difficulties that may prevent them from successfully developing literacy skills.

The prevalence of language difficulties among children from economically disadvantaged areas is very high in Britain and America (Locke, et al., 2002). Children from areas of economic disadvantage have been found to have smaller vocabularies and less complex sentence structures than children from non-disadvantaged communities (Arriaga, Fenson, Cronan & Petnick, 1998; Hart & Risley, 1992; 1995; Pan, Rowe, Singer & Snow, 2005). Maternal education has been found to have an even higher impact on language abilities

than income (Restrepo, et al., 2006). Children whose mothers have lower education levels tend to score lower in standardised tests on both receptive and expressive language, and receptive and expressive vocabulary (Whitehurst, 1997; Washington & Craig, 1999). The total mean of receptive and expressive language achieved by preschool children from designated disadvantaged areas in Britain in the study conducted by Locke et al. (2002) was 84.3 standardised score points, which in norm-referenced comparison is indicative of a mild language delay (range within norms for age: 85-115 standardised scores). Whitehurst (1997) noted that children reared in poverty perform on average one standard deviation below the mean on measures of receptive vocabulary.

In Ireland, language intervention was identified as one of the top priority issues in inner city areas of Dublin, as well as outer lying Ballyfermot and Blanchardstown (Downes, 2004; Downes et al., 2006; Downes & Maunsell, 2007). The presence of language difficulties in areas designated as disadvantaged have been recognised in the Irish context by the Department of Education and Skills (DES) DEIS strategy (2005), the authors of which recommend speech/language therapy services on-site in schools in designated disadvantaged areas.

Downes (2004) quotes a representative from a local organisation in Ballyfermot who suggested that children with hearing problems are not being identified in Ballyfermot schools (p. 8). The prevalence of hearing problems in the areas studied in this report is unknown. Some international researchers report worrying number of children with hearing difficulties in regular classrooms, a potential concern that has been relatively neglected in Ireland. For example, Eriks-Brophy and Ayukawa (2000) found that 26% of children in Nunavik,

Australia, had some degree of hearing loss while McSporran et al. (1997) found

that 16% of children participating in their study failed pure tone audiometry.[18]

The authors of one of the first studies on SFA, the MARCS Project Studies

1979-1993 (Flexer, 1989; 1992; Ray, 1992), who initially intended to study only

children with hearing difficulties, found that nearly 30% of children from regular

classrooms failed the hearing assessment. Further, Rubin et al. (2007) noted,

after assessing hearing levels of 947 children from New Brunswick classes of

kindergarten to third grade, that if their findings were applied to a class of 20

pupils 'three to six of the pupils would not pass the hearing screening and would

require follow-up' (p.vii). The presence of potential hearing difficulties in Irish

regular classrooms has not been explored in depth. Irish early childhood studies

1990-2006 have not focused sufficiently on this crucial aspect of readiness for

learning (see Walsh & Cassidy, 2007, for a review of studies 1990-2006).

The existence of a link between socioeconomic status and otitis media

('glue' ears) is debatable, with some researchers claiming socioeconomic status

to be a risk factor for the development of otitis media (Paradise et al., 1997) and

others not (Iwai et al., 1999) (see also Jessen & Beattie, 1990; Okur et al., 2003

for reviews). The estimation of the prevalence of otitis media is a complicated

issue, as otitis media can have many forms and its various definitions have been

applied by various studies (Shekelle et al., 2003). Otitis media is broadly defined

as 'fluid in the middle ear' that can affect hearing (Shekelle et al., 2003, p. 10).

One study quoted by Shekelle et al. (2003) reported that among children aged 2-

6 as many as 53% experienced at least one episode of otitis media in the first

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[18] This hearing test was administered to 25 study participants; 4 children failed the test. These 4 children came from the same class. Pure tone audiometry is a commonly used by audiologists hearing test that measures hearing sensitivity. It is a behavioural test as it relies on a test-takers' responses to pure tone stimuli.

year of the study, 61% experienced at least one episode in the second year and 30% had recurrent otitis media (Stool et al., 1994). Although a study on otitis media conducted on an American population by Shekelle et al. (2003) concluded that there is no evidence that otitis media in early life impacts on speech and language development, some researchers strongly claim that episodes of otitis media tend to have negative effects on the development of language and literacy (Winskel, 2006). In any case, early life recurrent otitis media carries a greater risk of experiencing conductive hearing loss at age 6-10 (Shekelle et al., 2003, for a review) and hearing loss is likely to hinder further language growth. The benefits of sound field amplification system for children experiencing mild hearing difficulties were noted by, for example, Crandell et al. (1995) and Flexer et al. (1994).

1.6 Multidimensional Model of Language

In accordance with the current model of good practice in the SLT field, this study utilised a mixed method design with a combination of standardised tests and contextually-based language assessments. Contextually-based language assessment is a strength-based assessment that allows the observation of a context in which language is assessed, and in which language develops. Nine language dimensions, commonly studied in the SLT field, not previously studied together in the SFA literature, were examined, contributing to a wide language profile of each study participant. Their importance as elements of a contextually-based language assessment of children with potential language difficulties will be discussed in chapter three. These dimensions include: participation and

responsiveness in the classroom, loquacity, syntactic complexity, pragmatic appropriateness and grammatical correctness of children's contributions, as well as norm-referenced receptive language, expressive language and receptive vocabulary. The linguistic profile of each of the 65 study participants was based on eight of the above dimensions.

This thesis thus introduces a multidimensional model of language with a focus on the dimensions that regulate the classroom discourse, such as responsiveness and participation (Adams et al., 2006; Evans, 1996), the structural dimensions, such as loquacity, syntactic complexity and grammatical correctness (Dunn et al., 1996; Lund, 1993; Wiig et al., 2004), as well as dimensions of pragmatic appropriateness (Adams et al., 2006; Bishop et al., 2000), receptive language, expressive language and receptive vocabulary. These dimensions have a potential to differentiate children who experience language difficulties from their typically developing peers (Adams et al., 2006; Lund, 1993; Scott, 1995). The three latter dimensions, namely receptive language, expressive language and receptive vocabulary, are commonly studied in the speech and language literature and are frequently assessed by means of standardised tests of language (Dunn et al., 1996; Wiig et al., 2004). The following accounts give an overview of language dimensions that were assessed dynamically, i.e. in a naturalistic setting of the classroom and from more than a single time performance (see chapter three for elaboration on the method of scoring of these dimensions).

Two dimensions that regulate classroom discourse were measured in the classroom, namely participation and responsiveness. Children with language difficulties have been reported to be either non-responsive discourse partners

(Fey et al., 1986) or less responsive discourse partners (Bishop, et al., 2000). Although Bishop et al. (2000) note that there could be a great deal of variation in levels of responsiveness in children with language difficulties, this measure was considered important in the present study as data collection occurred in a classroom context where children may have difficulties in hearing the teacher's questions (this is less likely to occur in dialogic exchange with one adult). It is assumed that children with language difficulties are additionally less likely to engage voluntarily in discourse and less likely to initiate conversational turns. Also reticent children, who do not volunteer to verbally contribute in classrooms, usually score lower on language tests (Evans, 1996).

An error that leads to a communicative breakdown such as silence (lack of response), confusion or misunderstanding (pragmatically inappropriate/inadequate response) is more informative than simply something said wrong (Lund, 1993).[19] Pragmatic appropriateness/adequacy of children's responses was another dimension measured in the classroom. Pragmatically inappropriate or inadequate responses are responses that are either conversationally inappropriate because of their irrelevance to the soliciting utterance or that are conversationally inadequate because of some linguistic limitation or a comprehension failure (Adams et al., 2006; Bishop et al., 2000). It is recognised in this thesis, in concurrence with a constructivist model of language, that communication is not a straightforward exchange of fixed meanings (Glasersfeld, 1995). Language is viewed in this perspective as a self-organising system, which implies that each child builds up its own meanings to

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[19] Dunn et al. (1996) found that children with clinically identified specific language impairments make more 'role errors', which were defined as failures to respond to a question that was required by discourse rules, than their normally developing peers.

words and concepts based on own experiences (so his/her language system is self-regulated by experiences).

Thus, in judging pragmatic appropriateness of children's responses, attention was paid to observing whether the meanings of the teacher and the pupil were 'compatible' (Glasersfeld, 1995) and whether the largest concept differences were avoided (see the examples of conversationally inadequate responses in chapter three). Bishop et al. (2000) noted that children with specific language impairment (SLI) produce many conversationally inadequate responses due to some deficiencies in either word or sentence structure knowledge. While word knowledge is constructed by individuals, these constructions need to be compatible, or in co-ordination, with other people's constructions (Glasersfeld, 1995).

Syntactic complexity and loquacity were two further dimensions observed in the classroom in this study. Syntactic features are well defined and widely used in language diagnoses of pre-school children (Scott, 1995). The use of complex syntax requires displacement from immediate time and space and allows one to create temporal and causal relationships of thoughts. Children with language difficulties often experience difficulties comprehending structurally complex sentences (with higher idea density) and they often do not produce such sentences themselves. Quantifying the production of syntactically complex forms has been used in various previous studies evaluating intervention efficacy (Fey, 1986; see Lund, 1993, for a review; Scott, 1995). Syntactic forms change with the purpose and the function of discourse and so a variety of lessons (in terms of a lesson content and a lesson subject) with a range of discourse genres (such as explanation, reason, opinion) were advantageous for analysis of this

dimension. The wealth of discourse types in school includes also informational language (e.g., giving directions) as well as often studied conversational and narrative languages (Scott, 1995).

Quantification of complex sentences proves a very useful index of language proficiency for cultural and linguistic minority children as syntax tends to be less affected by socioeconomic status or race than other language measures, such as, for example, vocabulary or other 'contrasting' features such as use of morphemes[20] (Seymour, et al., 1998). In differentiating between a difference and an impairment of non-standard English speakers, it is advisable to focus on *non-contrasted* features (i.e. shared features) between the standard English and the dialect spoken by the studied subjects (Seymour et al., 1998). Syntactic features are non-contrasted features (Seymour, et al., 1998), that is, they do not differ among dialects as much as other language dimensions, such as vocabulary. This research focuses largely on non-contrasted features of language, namely verbal discourse participation, responsiveness, loquacity and syntactic complexity, comprehension of linguistic concepts (e.g., *before, under*), basic concepts (e.g., *full, tall*) and word classes (e.g., *animals, clothes*), as well as the ability to build complex sentences. In its complexity, the language of young children is considered 'non-dimensional', that is there should be no large discrepancies in the abilities in its various dimensions (Tomblin & Zhang, 2006). In other words, the child whose language is not structurally complex is likely not to initiate dialogue, as well as to have lower responsiveness level and weaknesses in comprehension of elaborated language.

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[20] A morpheme is the smallest meaningful unit of language (e.g. –ing, -s for plural, -de in de-contextualization, he, I, went).

Research indicates that literate language is a good measure of distinguishing children with language difficulties from their typically developing peers as well as a good predictor of literacy levels (Greenhalgh & Strong, 2001; Whitehurst, 1997). Quantification of other than complex sentences features of literate language was considered redundant in this study as the density of conjunctions is thought to be positively correlated to the density of adverbs and complex elaborated noun phrases (as found, for example, by Curenton & Justice, 2004, in African-American and Caucasian population pre-schoolers). Tomblin & Zhang (2006) suggest that researchers may consider reducing language measures used when studying the language of young children as many dimensions of language overlap in young children.

It is generally recognised by speech and language therapists that children with language difficulties may experience difficulties in either sentence structure, i.e. with the syntactic roles of words in formulated sentences, or in word structure, i.e. with the use of grammatical markers (of tense, aspect, case, number, comparison). They often master morphological rules (e.g., plural, possession) slower than their normally developing peers (Wiig et al., 2004, p. 91). In a constructivist model of language, one could say that these children 'experiment' with utterances in their interactions with others for longer than a majority of their typically developing peers (Glasersfeld, 1995). A composite measure of syntactically and morphologically incorrect utterance adopted in this study was used in many previous international studies that analysed children's language samples (Dunn et al., 1996; Fletcher, 1992).[21]

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[21] Some studies created a separate category for 'incomplete utterance' and differentiated it from 'grammatically incorrect' and 'pragmatically inappropriate' (Grela & Leonard, 2000). Such differentiation, however, would be useful for analysing sentences only and in the present study, sentences constituted only a part of the total of children's responses.

1.7 Chapter Summary

This introductory chapter presented a context and a rationale for the use of classroom sound field amplification systems in regular classrooms. It discussed the elements of the classroom acoustics such as noise, sound-to-noise ratio (SNR), reverberation time (RT) and speaker-listener-distance, a discussion that is crucial to the understanding of the role of this intervention in the classroom. The importance of classroom acoustics has not been sufficiently addressed in the Irish early education literature to date (Walsh & Cassidy, 2007) with no acoustic guidelines on classroom design currently existing in Ireland. By improving intelligibility as well as audibility, SFA enables the pupils to hear the teacher more clearly and more consistently, thus purportedly accelerating learning, including the language learning. There is some evidence that language and literacy difficulties are more prevalent in Ireland among children in designated disadvantaged schools (Downes, 2004; Downes & Maunsell, 2007). Based on this evidence, the study focuses on the potential of this intervention to support language development of children aged 4-7 in 7 urban DEIS schools in Ireland.

The study examines if classroom sound field amplification can play a causal role in a system of elements that bring improvements for the specific population of young early primary children in urban designated disadvantaged schools on a number of language dimensions. The multidimensional model of language, that provides for the complexity of language and for the diversity of the studied sample, is introduced in this study for the first time in the SFA literature. In accordance with current guidelines in the speech and language

therapy field (ASHA, 2001; IASLT, 2010), both static and dynamic assessments of language were conducted. This thesis introduces a systems approach to the study of this intervention, another novel approach in the current SFA literature. The systemic perspective situates SFA in the context of other elements of the child's system and specifically in the context of the classroom microsystem, thus contributing an innovative in the SFA literature analytical framework that combines the observations of language behaviours with the observations of the context and the interactions in the classroom.

SFA may constitute a supportive classroom intervention for populations where a higher number of children require additional supports, its large advantage being that it does not withdraw children from the class. Some Irish researchers recommend that, in areas designated as disadvantaged, efforts should be directed at classroom-based interventions as opposed to those interventions that operate on a withdrawal basis (Eivers et al., 2005). This is due to the fact that large numbers of pupils require additional support in regular classrooms in designated disadvantaged areas. This examination of SFA is not with a view to investigate the extent to which SFA can replace additional out-of-class learning support or alleviate children's difficulties that require intensive individual or small group intervention. Rather, it is examined whether SFA can provide a classroom support for those children who might require additional out of class learning supports as well as provide a better learning environment for pupils who otherwise might not have been able to present their full potential in the classroom.[22]

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[22] Flexer & Long (2003) found for example that the number of referrals to special education classes was lower in classes fitted with SFA.

SFA is conceptualised in this thesis as a supportive intervention, being one element of the complex system of classroom resources. It is recognised that a number of conditions need to be met for maximum learning to take place, including good in-school attendance, supportive family structures, good quality teaching and good classroom acoustics, to name but a few, and as well as that SFA cannot compensate for poverty or emotional issues. This systemic perspective will be elaborated in the following chapter, which will provide an overview of systems theory perspectives relevant to the context of SFA in the classroom, and relevant to the conceptualisation of this intervention outside of a simple causal model.

CHAPTER TWO

The Conceptualisation of SFA within Systems Theory Approaches

This section begins with an outline of systems theory perspectives that constitute a conceptual framework underpinning this thesis. This outline is followed by an application of systems theory to education and to the understanding of the efficacy of SFA in the classroom. The conceptual framework within which SFA is situated is based on combined theories of Bronfenbrenner's (1979) nested systems, living organic systems theory as applied to education (Downes & Downes, 2007; Zappone, 2002) and Prigogine's (1984) complex non-equilibrium systems.

2.1 Overview of Systems Theory

The concept of a general system was first introduced in the 1920s and 1930s by the General Systems Theory (GST) movement (Bertalanffy, 1957) that propagated wholeness and its application to various fields traditionally considered separable and studied in isolation. In simple terms, systems theory is an interdisciplinary field that takes a holistic view of every organism in order to reflect its truer nature. This, as noted by Capra (1983), is in contrast to a Cartesian philosophy of fragmentation. Systems sciences have greater unifying and heuristic powers than traditional sciences, i.e. they can connect concepts

belonging traditionally to separate fields and open up new directions of enquiry. They have been applied to understanding of various groups of objects and/or people in nature, society and science, including the understanding of complex phenomena such as poverty or crime and the understanding of social settings (Bertalanffy, 1957; Tseng & Seidman, 2007; Foster-Fishman & Behrens, 2007). Hardy (2001), for instance, describes cognitive webs (e.g., the human mind) and social webs (e.g., small groups of people) as examples of complex multi-level webs, a multi-level web being a specific type of system with numerous 'inter-influences'. Tseng and Seidman (2007) focus on youth settings and schools as examples of social settings, while applying a systems approach to introducing systems change in them.

Systems are organisms that consist of parts working together where the sum of the parts does not however equal the whole and where the functioning of a whole may not be apparent from functioning of its parts (Capra, 1983; Hirsh et al., 2007). In a system, it is the quantities (e.g., the number of children in a class), the qualities (e.g., the quality of teaching) and the interdependencies between the system parts that matter (Kelly, 2007).[23] Systems sciences go beyond simple linear causality. Foster-Fishman and Behrens (2007) argue that systems thinking requires the recognition of the multi-directional cause-effect relationships between systemic parts. Some system theorists, such as Hardy (2001) disagree, however, even with the existence of multi-directional cause-effect relationships in a system. As Hardy (2001) argues, there are various processes occurring *simultaneously* in any complex web, and one must go far beyond causality, whether linear or circular, in understanding the dynamics of

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[23] Foster-Fishman and Behrens (2007) argue that the term 'system' is much more appropriate than 'context' when it comes to social settings as it allows the focus on interactions and interdependencies existing within them.

complex and multi-level webs. The perspective adopted in this thesis is one of multi-directional cause-effect relationships and *complex* causality.

In recent years, systems sciences have gained an increased interest in the field of community psychology, an interest that resulted in a special issue of an *American Journal of Community Psychology* in 2007 that was entirely devoted to systems theory. Many papers in this special issue include practical applications of systems theory to organisations, such as schools or businesses, mainly during some transformation time. Examples of applications of systemic approaches in psychology have been frequently present in studies relating to the understanding of ADHD and treatment of externalising behaviours that recognises the importance of a family system (Johnson, 2003; Stacks, 2005; Stolzer, 2005).[24]

With systems theories currently receiving increased attention, there may have been much focus on them in psychology. However, systemic orientation has not been fully used in research *practice* (Christens et al., 2007; Hardy, 2001; Hirsh et al., 2007; Parsons, 2007). As Downes (2007) observes this was recognised already by Rutter (1985) in his critique of simple assumptions in psychology that single variables may have main causal effects. Hirsh et al. (2007) add 'We continue to rely on methods that assume a very different kind of world than the one that is reflected in the settings in which we work' (p. 239) and further '(…) we too often elect to ignore the interdependencies among real world processes (…)' (p. 240). Justus (2005) notes that equilibrium explanations (more qualitative), i.e. explanations that situate trajectories in more

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[24] Johnson (2003) observed how whole family functioning may affect a child's externalizing behaviours in schools. As opposed to the majority of studies researching family systems, Johnson (2003) observed the dynamics and organisation of *the whole family*, i.e. mother-father-child interactions, as opposed to dyadic parent-child interactions.

encompassing structures, may be more explanatory than causal explanations (more quantitative), i.e. explanations that focus merely on trajectories, as equilibrium explanations enhance the understanding even though paradoxically they may provide less information.

It is recognised that systems theory encompasses a wide range of approaches, many of them situated far beyond the scope of this thesis. The following accounts will present the application of systems theories to the understanding of SFA. As it was already argued, a majority of previous SFA studies follow a simple causality of one-antecedent-one-consequence. Their authors firstly assume that SFA is to bring benefits in a given dimension without observing the system in which SFA operates, and secondly, they conclude that the observed gains are *causally* and *solely* attributed to SFA. This model fails to recognise that SFA is a supportive intervention, which needs certain conditions 'to work'. These conditions are created by the child's crucial systems, namely family, school and classroom systems, with a classroom microsystem being the main focus of this thesis. In order to introduce the context for observing the classroom microsystem, the following accounts will focus on Bronfenbrenner's (1979) ecological theory. This theory provides a categorization of concepts helpful in describing the classroom system.

In his ecological model of learning, Bronfenbrenner (1979) builds a nested model of systems crucial in a child's development, a theory that is elaborated on below with relevance to SFA. The ecological perspective recognises, what is now an obvious statement in psychology, that the environment shapes the behaviour of the individuals contained within it, as well as that the events taking place beyond a single setting have an influence on the development as much as

those that take place within the settings where the individual is not even present (Bronfenbrenner, 1979). Yet, while this perspective is frequently taken in theory, it is rarely put into research practice in the area of education. When applied to the evaluation of SFA, it directs the focus on both the observed individuals as well as on their broadly defined environment and the interaction between the two. This perspective helps in understanding that the same intervention may have different outcomes in different classrooms, schools and communities.

2.2 Bronfenbrenner's Systems

Bronfenbrenner's (1979) original ecological model, built on a nested structure of layers from Lewin's (1951) work[25], included four nested systemic levels affecting individuals - the microsystemic level, mesosystemic level, exosystemic level and macrosystemic level. These nested structures of the ecological environment contain of the immediate setting with the individual (microsystem), the relationships between the settings, i.e. 'a system of microsystems' (p. 25) (mesosystem), the remote settings of the community in which the individual may not be present but which influence the immediate setting containing the individual (exosystem[26]), and a larger community that contains a sort of a blueprint for the other systems (macrosystem[27]). Bronfenbrenner (1979) calls this ecological environment a 'nested arrangements

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[25] Lewin's (1951) field theory proposed that a behaviour (B) was a function (F) of the person (P) and the environment (E) with lifespace (LSp), i.e. a field of interactions, (LSp) totalling B+F(PE).

[26] Exosystemic level includes resources and processes within the community and neighbourhood (taking into account that the school is also a community).

[27] Bronfenbrenner's (1979) macrosystemic level includes society and broader issues such as policies, economics, cultural values and beliefs (Durlak, et al., 2007).

of concentric structures' (p. 22). With relevance to SFA evaluation, one needs to be aware that SFA is one part of a complex microsystem of the classroom, which is influenced by other meso-, exo- and macrosystemic levels (Bronfenbrenner, 1979).

An exosystemic level might, for example, explain differences in intervention outcomes between two geographically different communities with the same intervention (in relation to SFA data, this might explain why SFA might be beneficial in one school or in one geographical location and not in the other). Some communities, for instance, have more community-based resources and more interventions introduced at its various levels (e.g., community-based parent classes, school-based creative art therapies, networking forums facilitated by local area partnerships). The combined effort of all these initiatives contributes to the strength of the community.

Most importantly, however, there are three interrelated major sub-systems to be considered in the SFA study, and wider in the development of language, namely classroom, school and family, each sub-system with its major key players (Janzen et al., 2007). Parents and siblings are major key players in the family subsystem, the teacher and other pupils are major key players in the classroom subsystem and the learning support teacher, the language support teacher and the school-based or visiting speech and language therapist may be major key players in the school sub-system.[28] Following Bronfenbrenner's (1979) model, Janzen et al. (2007) order the elements of the system according to

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[28] Modyfying Bronfenbrenner's work, O'Connor (2007) distinguishes *adjacent* systems (parallel systems), *overlapping* systems (some participants in one system are also in another system) and *overarching* systems (one system is subsumed under another) (p. 393). When applied to SFA, these types of system clusters may help to organise the network of in-school factors influencing the efficacy of SFA. Classrooms within one school can be considered adjacent systems, class/school relationship could be considered overarching and classroom/resource teaching relationship could be considered overlapping.

the proximity of relationships of its key players. Bronfenbrenner (1979) emphasises we are most influenced by those with whom we create direct relationships. While all Bronfenbrenner's levels are applicable to the *theoretical* understanding of SFA in the classroom, it is the microsystemic level that informs the methodology of this SFA evaluation by providing a framework of elements to be observed in a complex web of a classroom microsystem.

Bronfenbrenner himself acknowledged that the first ecological system he proposed, developed directly from Lewin's (1951) field theory model, was a static system (1986). He introduced its further *dynamic* dimension i.e. a chronosystem, a sub-system that relates to the dimension of time and explains the dynamics between the individual and its context over a period of time. Further configurations of Bronfenbrenner's ecological model included the development of its bio-ecological dimension, which addresses both the structural/biological and the process/socio-cultural dimensions of development (Bronfenbrenner & Morris, 1998). It is Bronfenbrenner's attention to the *interactions* within these structural and process dimensions and his direction toward a more dynamic system encompassing the dimension of time that links Bronfenbrenner's ecological model with systems theories.

The *chronosystem* may be very relevant to the understanding why SFA may be more beneficial for an individual at one point of time but have much less impact on the same individual at another point of time. In other words, the timing of the intervention can play a huge role in its efficacy (e.g., if a child experiences some problems in the home situation, he/she may be less likely to benefit from the classroom intervention). The age of the child when the intervention is introduced as well as the length of exposure to the intervention

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and cumulative effect of various systemic changes on the child's development can also be explained in terms of the chronosystem.

2.3 The Elements of the Classroom Microsystem

It is generally agreed that beside the family, the classroom is a crucial proximal environment for the children. An ecological model proposes that human development is primarily influenced by what is termed 'proximal processes', i.e. by bi-directional *interactions* between people and their immediate environments (Bronfenbrenner, 1979, p. 219, italics not in original). The interactions between the persons present in a microsystem are in turn shaped by the elements of this microsystem. Bronfenbrenner's ecological model proposes three aspects of the microsystem, namely the pattern of activities, interpersonal relationships and social roles. These aspects either enable or inhibit the development occurring in a proximal environment. One must recognise further that the form, power, content and direction of these proximal processes are in turn affected by both immediate and remote settings and by both present and past processes at both biological and socio-cultural levels (Bronfenbrenner, 1979, 1986; Bronfenbrenner & Morris, 1998).

Current system theorists recognise the importance of social processes in social systems, highlighted also in ecological models, and offer further models of the dynamic of the social systems. For example, according to Tseng & Seidman (2007), three aspects characterise the system dynamic of social settings, including the classroom setting, namely social processes, resources and organisation of resources. Tseng and Seidman (2007) consider social processes,

i.e. the interactions between the setting participants, to be the most critical aspect in a social setting. Following this consideration, they propose that it is the domain of social processes encompassing adult-child interactions that should be prioritised for an intervention. The quality of a teacher-pupil interaction, as a crucial element of an intervention, has now been well recognised in an Irish early childhood education context (McGough, 2007; 2008).

Tseng and Seidman (2007) recognise the multiplicity of interactions between the setting variables when they observe that 'social processes are shaped by individuals' roles within the setting' (p. 219) and that each setting has thus multiple social processes. They include three overlapping constructs within social processes: norms, relationships and participation, where norms mean attitudes, beliefs and expectations. The teacher's attitudes, beliefs and expectations, both towards the pupils and the intervention, are crucial for understanding the outcomes of any classroom-based interventions. This has now been well recognised in the education literature (Brophy, 1985; Good, 1981; Rosenthal, 1968; Rubie-Davies, Hattie & Hamilton, 2006; Weinstein, 2002), particularly in the context of educational disadvantage (Espinosa & Laffey, 2003; Good, 1981). The classroom climate that is reinforced by a warm, supportive teacher who creates warm, supportive relationships with the pupils is another factor critical in analysis of the classroom system. Numerous researchers highlighted the developmental benefits of a warm and trustful pupil-teacher relationship (Bronfenbrenner, 1979; Baker et al., 2008, Walker, 2008)

While SFA can be considered a classroom *resource,* by amplifying the teacher's voice and hence the teaching instruction, it can have an influence on teacher-pupil interactions and become a part of classroom *social* processes. It

may thus be possible that in classrooms where teachers do not shift power relations in favour of children, SFA may actually bring about detrimental effects, strengthening what Freire (1972) terms a banking model of education. Freire's (1972) banking model of education refers to classrooms with an authoritarian teacher where the knowledge is 'deposited' into pupils, as opposed to social-pragmatic models of teaching and learning - rooted in the writings of Vygotsky (1978) - which place a teacher and a pupil in an interactive relation (Tomasello, 1992).

Beside social processes, Tseng & Seidman (2007) point to resources and organisation of resources as important aspects of social settings. Early education researchers have identified a number of aspects relating to resources and their organisation, and contributing to development in early education settings, among them staff training, the organisation of a learning space, including the size of the class and the classroom as well as the acoustic qualities of the latter, and the availability of resources (CECDE, 2007b; Darmody et al., 2010; Hayes, 2004). They recognise that it is the overall dynamic of these elements − comprising structural and process variables *as well as* the interactions between them - that influences the development. As Hayes (2004) notes, most current researchers of early education field recognise the presence of this dynamic, at least at a theoretical level. This recognition can be placed within the general concepts of systems theory.

The level of human resources and specifically the knowledge, skills and abilities of the teachers using the SFA is likely to have a strong influence on the outcome of the intervention. On the other hand, the system norms, i.e. the attitudes, beliefs and expectations, both those that underline the teaching

philosophy and teaching methodologies and those related to SFA, are also likely to influence the desired goals of the intervention. Foster-Fishman et al. (2007) emphasise that in a balanced system, all aspects need to work well. So for instance, if the teacher believes in SFA but does not possess good knowledge or skills to provide quality language instruction, then the outcome of the intervention may not be as expected. Conversely, if the teacher has good teaching methods but she/he does not use SFA due to a disbelief in its benefits, one naturally cannot talk about any outcomes that are related to SFA. The following is a more in depth elaboration on two inter-linked elements of the classroom microsystem, namely the group size and the quality of classroom interaction, that have been identified in research as specifically affecting the development of language in the classroom (Finn & Achilles, 1999; Girolametto et al., 2000; Girolametto & Weitzman, 2002; Hargreaves et al., 1997; McGough, 2008; Tomasello, 1992; Weitzman & Greenberg, 2002; Walsh & Blewitt, 2006; Whitehurst et al., 1988; Whitehurst, 1997).

2.3.1 Group Size

The advantages of reduced size classes are currently hotly debated internationally (Darmody et al., 2010). Already Bronfenbrenner (1979) cites Travers and Ruopp's (1978) study of American preschoolers (3-5 year olds) who observed that teachers of small groups interacted more with children than teachers of larger groups. Another important observation of Travers and Ruopp (1978) is that children's participation and interest levels were higher in smaller groups than in larger groups. The size of the group may also play an important role in shifting of power between the adults and the children (Bronfenbrenner,

1979). Research findings supporting the advantages of reduced class size for pupil learning have been replicated by more recent studies (Blatchford, Goldstein, Martin & Browne, 2002; Blatchford, Russell, Bassett, Brown & Martin, 2006; Clanet, 2010; Hargreaves et al., 1997; Hunn-Sannito et al. (2001); see Januszka & Dixon-Krauss, 2008, for a review).

Clanet (2010) studied 200 first grade American classrooms and found that the average level of pupil achievement was greater in classes with fewer than 15 pupils per class than in classes with 20-25 pupils per class. Hargreaves et al. (1997) noted that in smaller classes (with a mean number of pupils equal 13.8), pupils received more teacher attention, more challenging questions and were engaged in more sustained interactions, as compared to pupils in larger classes (with a mean number of pupils of 28.8). Blatchford and colleagues in the UK (2006), where the teaching methodologies utilize more group work approaches than in American schools, found that 7-11 year old pupils played a more active role in smaller classrooms. They concluded that the quality of teaching is likely to be more beneficial in smaller classes.

Tseng and Seidman (2007) give examples of further recent studies that support the view that pupils learn more in smaller classes as they receive more attention and higher quality teaching, as well as more teaching, as the teachers in smaller classes spend less time on classroom management and more time on teaching. Furthermore, Finn & Achilles (1999) showed that pupils in smaller classes achieved higher scores in *language* than their counterparts who attended classes with higher number of pupils. These results were maintained into further years of school, even if those pupils were not in small size classes anymore.

'It is probably true to say that there is broad agreement among researchers and practitioners that smaller class sizes enable teachers to provide better quality education on the assumption that there is more time for interactions which may be considered an important mediating mechanism for development and learning' (CECDE, 2007a, p. 21). Blatchford et al. (2006) note, however, that the reduced class size can bring benefits to learning only if the teaching quality supports it. In other words, one cannot simply assume that the reduced class size will bring universal benefits in every setting. This recognition takes into account the complexity of elements creating dynamic systems as a factor potentially mediating the effects of the reduced class size (e.g., the teaching methodologies used by the teacher). The current study takes a similar approach to conceptualising SFA as an educational intervention, namely it goes beyond the narrowly deterministic assumption that SFA brings benefits in each classroom system.

2.3.2 Quality of Classroom Interaction

The ecological context of the classroom, with teaching as its crucial element, is a significant contributor to children's learning, including their language acquisition. A large body of literature supports the now obvious statement that experiences within the classroom (and school) contribute to pupils' competence growth and competence change (e.g., Maughan, 1994; Rutter, 1983). While a detailed review of the literature relevant to good quality teaching is beyond the scope of this thesis, it is crucial to acknowledge key aspects contributing to the quality of classroom interaction, i.e. the nature, quality and quantity of the adult-child exchanges. It must be acknowledged,

however, that classroom interaction is a multi-levelled construct with a variety of elements contributing to it. The following represents a summary of classroom elements relevant to *language* development only.

Literature within the social-interactionist model of language acquisition (Tomasello, 1992), based in the writings of Vygotsky (1978), shows that specific aspects of adult speech are facilitative for child language development, especially for children from areas designated as disadvantaged (Whitehurst, 1997). These include aspects of language modelling, including labelling, and discourse enabling techniques including expanding and extending, as well as adult questioning techniques (Girolametto et al., 2000; Girolametto & Weitzman, 2002; McGough, 2008; Weitzman & Greenberg, 2002; Walsh & Blewitt, 2006; Whitehurst et al., 1988; Whitehurst, 1997). The nature of linguistic interaction and the context for language use can either enable or hinder the presence of some linguistic features (e.g., the presence of more complex sentence structure) (Dickinson, 2001a; 2001b; Scott, 1995). For instance, enabling narrative and expository discourses in the classroom, in addition to a conversational language mode, can affect pupils' language performance (Scott, 1995).

It is recognised in this thesis that a focus on adult-child interactions, and further on a presence of certain aspects of adult speech in adult-child interactions, should be balanced with a current child-initiated model of early childhood education. The use of the specific aspects of adult speech that facilitate language learning in children should be conceptualised within a *reciprocal* model of interaction, not as single adult contributions. Most researchers within the SLT field concur with the model of reciprocal

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interactions, i.e. that language development is facilitated best in dyads of joint attention and dialogue, and *not* in an instructional model of teaching.

The nature of the teacher-child relationship and the teacher's sensitivity and responsiveness are two crucial elements of the classroom climate that were found to be correlated to the rate of language acquisition for kindergarten and pre-kindergarten children (Mashburn et al., 2008; Pianta et al., 1997).[29] The classroom climate, a multi-dimensional construct that has gained increased attention in recent Irish literature (Darmody, 2007; Downes et al., 2006; Downes & Maunsell, 2007; NESF, 2009), created by the level of interaction and affection and the power relations between the teacher and the children, is potentially of huge importance to pupil achievement. Darmody (2007) argues that classroom and school climate, largely depending on the quality of pupil-teacher interactions, may impact profoundly on the pupils' educational outcomes.[30] Attention to classroom climate is crucial in SFA efficacy studies. The availability and quality of curricular materials and classroom resources, including SFA, matter only if they either influence teaching or enhance it. If the teacher is highly qualified and knowledgeable (resource), but the class climate is not warm and supportive (social processes), the benefits of SFA may not be as great as expected.

According to Bronfenbrenner (1979), there are three aspects that qualify the relationships one creates with significant others, namely reciprocity,

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[29] Researchers link classroom climate also to competencies other than academic. Wilson, Pianta & Stuhlman (2007) proved that high quality of emotional support coupled with high quality of evaluative feedback, can significantly contribute to higher social competence of pupils. This focus is, however, beyond the scope of this thesis.

[30] Mashburn et al. (2009) characterise positive classroom climate in terms of enthusiasm, enjoyment, and respect displayed during interactions between the teacher and children and among children, and negative classroom climate by a negative emotional and social tone (i.e. displays of anger, aggression, and/or harshness).

affective relation and balance of power. Bronfenbrenner highlights that the most beneficial for the developmental situation is when the power balance is shifting towards the developing child, i.e. 'when the child controls the situation' (p. 59). Current models of language learning recognise the importance of the child's initiations, and the adult responses that expand and elaborate *on* the child's contributions (Pepper & Weitzmain, 2004; Tomasello, 1992; Weitzman & Greenberg, 2002). Speech and language therapists also recognise a *contribution of a warm* and *caring* adult in language acquisition (Geller & Foley, 2009). This is in concurrence with the concept of responsive interaction recognised as hugely important in early education settings (Bredekamp & Copple, 1997). Language learning is more likely to occur in classrooms with a positive climate where the teacher creates a warm relationship with the pupils.

Role expectations influence and are influenced by both the content of activities and the relations in dyads (Bronfenbrenner, 1979, p. 85).[31] For instance, a pupil in a classroom perceives himself/herself in a particular role within a classroom system, and depending on the teacher's style of teaching and the teacher's choice of the teaching methodologies, may perceive himself/herself as a listener or as an active participant in a classroom discourse. Changes in social imagination, i.e. in the perception of the system by the individuals within it, may trigger a systems change (Christens et al., 2007). SFA may, by improving the classroom listening conditions, improve the pupils' attention and

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[31] A dyad is the basic unit of a microsystem. Bronfenbrenner (1979) distinguishes between three types of dyads, namely observational dyad (when the child only observes), joint activity dyad (when the child is engaged in an activity) and primary dyad (also termed phenomenological dyad) (e.g., parent-child dyad). Phenomenological dyad is present even if the persons creating it are absent. It is the most influential dyad in the child's development from which the child takes motivation, beliefs and attitudes.

their participation, and this may in turn modify the teacher's perception about these pupils.

As the content and range of activities in the classroom are inter-dependent with role expectations and the relationships in teacher-pupil dyads, Bronfenbrenner (1979) suggests that activities should be observed not only in relation to whether they are complex structurally (e.g., labelling colours versus picture interpretation) but also whether they are reciprocal (dialogic/interactive reading versus reading without children's involvement), emotionally/affectively positive (positive classroom/school climate versus authoritarian teaching) and shifting power balance in favour of children (initiating versus responding). All of the above aspects are analysed in the current study for each SFA study participant and for each studied classroom.

Thus, it is recognised that classroom context can have a potentially moderating effect on the impact of SFA in the classroom. This seemingly trivial element was absent in most previous SFA evaluations. One can argue that the SFA's effectiveness is setting specific if SFA brings benefits in only some classrooms and does not in other classrooms. This does not, however, prove that SFA is *not* beneficial; rather, it proves that SFA *can* be beneficial in some settings. The next step in such a situation is to find out when and in what contexts the SFA *can* bring benefits. The possible different intervention outcomes in different settings prove that the settings are different, i.e. following Bronfenbrenner's (1979) description of settings, that the activities, roles and relations in these settings are different. Bronfenbrenner states (1979):

If different settings have different developmental effects, then these effects should reflect the major ecological differences between the settings, as revealed by contrasting patterns of activities, roles, and relations (p. 183).

2.4 Variety of Systems Sciences and SFA

The following accounts elaborate on systems perspectives that inform the understanding of SFA as a classroom intervention. Firstly, different approaches within systems science are described briefly for the reader. Then, holistic and systemic perspectives in psychology of education are reviewed. It is recognised that a majority of current research into early education settings and early education interventions concur with ecological approaches (Bronfenbrenner & Morris, 1998). Downes and Downes (2007), however, emphasised in an Irish context the need to develop a more elaborated model of *systems* theory in education. In the final paragraphs of this chapter, an attempt is made to apply this more elaborated model of systems theory to education, and more specifically to the functioning of SFA in the classroom.

Systems science is not a unified field; it encompasses a variety of different approaches, most of which originate back to the first writings on systems in the second half of the twentieth century. As Schwarz (2007) noted, systems sciences are essentially rooted in four fields, namely cybernetics (Wiener, 1948; Foerster, 1984), General Systems Theory (Bertalanffy, 1968), Prigogine's far from equilibrium living systems (1984) and non-linear dynamics i.e. chaos theory (e.g., Lorenz, 1963). The General Systems Theory (Bertalanffy, 1968) movement recognised the existence of systems in various disciplines and postulated general principles and laws that apply to them. It advanced the

development of subtypes of systems sciences such as Miller's (1978) living systems theory (a further subtype of open systems) or Luhmann's social systems theory (1984), which will be referred to later on.

Cybernetics, distinguished by some theorists from systems sciences, is a field concerned with feedback and information that supports the understanding of control systems and explains regulatory mechanisms in nature and technology. Its relevance to SFA study will be mentioned below. Finally, chaos theory as a theory applied often to such complex phenomena as weather conditions or population growth seeks to find some underlying order in an apparent chaos of models of data, allowing however for some uncertainty about the system's future state. Systems science is a well-developed area with numerous differing subfields, the detailed description of which is beyond the scope of this study. In the following, systems theory approaches that are relevant to the study of SFA will be cited.[32]

The concept of far from equilibrium system, developed by Prigogine (1984), holds particular relevance to the development of this SFA evaluation. Prigogine (1984), who pioneered the concept of non-equilibrium in relation to open systems, contributed to the concepts of self-regulating living systems by advancing them with a theory of non-determinism, i.e. that systems evolve in the interplay of chance and necessity, instead of following a predictable pattern of logic law. Non-equilibrium is understood as a simultaneous state of dynamism

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[32] In discussing the application of systems theory to education, one must be cautious of not being overtly focused on *systemic* structures. Habermas (1987) critiques excessive focus on systems theory and the theory of complexity which as he puts it became 'hypertrophied' (p. 155). He questions whether social systems can be sufficiently explained in system terms and observes that the focus on the *organisation* of systems may lead to neglect of the processes seeking understanding and meaning in life and result in the loss of freedom and ultimately the experience of meaninglessness. Communication and consensus are key concepts in Habermas's (1987) understanding of social systems and one's efforts should be directed at how to improve communication and reach consensus crucial in social systems, rather than how to improve the order of the organisation through focusing on system regulations.

and stability inherent in the lives of organisms, which means that the system is neither organised nor disorganised (Capra, 1983; Parsons, 2007). Far from equilibrium systems exchange matter and energy with their environments, their elements strongly interacting with each other, creating complex dynamics. These complex dynamics can be seen as an apparent chaos as many real relationships of the system particles cannot be known and may be recognised only in a system's future state. These long-term relationships between system parts are a special characteristic of open far from equilibrium systems. Prigogine's theory dispenses with narrowly deterministic models of development and goes beyond simple linear approaches in systems, two perspectives that underpin this SFA study.

This thesis does not focus on Luhmannn's (1995a) social systems, as these concentrate on self-regulating *closed* systems and the distinctions between the system and its environment, as opposed to a focus on system dynamics. While the concept of autopoiesis[33] (Maturana & Valera, 1972), crucial for Luhmann (1995a), finds some relevance in this thesis as one that holds that a system cannot be understood simply by looking at its structure but that its organisation is equally important, this concept cannot be directly applied to the classroom system. The application of the concepts of autopoeisis and operational closure to the classroom sub-system would have implications for the *living* status of an educational system. Autopoetic systems are essentially closed systems that do not communicate with their environments and operate within themselves. Operational closure indicates that the system consists solely of structures that

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[33] Autopoiesis is understood as self-creation, self-production or self-reproduction, which occurs as the interplay of structure and organisation in a system. Although initially applied to living systems (e.g., a cell in biology), it refers rather to systems that are self-sufficient and independent of their environments. Some scientists have used the terms autopoiesis and self-organisation interchangeably.

were created within the system and were not a contribution from the environment. Although one may perceive classrooms as operationally closed as they are autonomous and can operate without external inputs, this perspective would potentially make classrooms dead, inorganic systems.

To conclude, concepts borrowed from systems science that will guide the conceptualisation of SFA in this thesis include living organic system, non-equilibrium system and some aspects relevant to the concept of feedback developed by the study of cybernetics. Their specific application in education and in this SFA evaluation will be discussed later in this chapter.

2.5 Holistic and Ecological Perspectives in Education

As Downes and Downes (2007) note, one example of holistic perspectives in education is the recognition of the Statutory Committee on Educational Disadvantage (2005) that society is a multi-layered system and educational disadvantage, as associated with economic and social disadvantage, cannot be 'tackled' by the schools alone, but that the whole communities need to be involved in lifelong learning for any changes to happen. In this holistic view, one can build a multi-layered tree of inter-relationships with schools being parts of a larger system of organisms and classrooms being parts of schools. Ecological approaches have been frequent in recent Irish and international studies (Chau-Ying, 2008; Doyle et al., 2009; Hayes et al., 1997; Seginer, 2006; Sharkey, 2007; Swick & Williams, 2006; Syverson, 2008). In fact, it would be difficult to find a recent study that does not agree with a view that individuals are situated within a broader social context.

Chau-Ying (2008), for example, examines music education with an ecological perspective pointing to a number of system-level factors that influence music development, including for example adult perceptions of children, family structure and teachers' pre-service training, while Syverson (2008) applies an ecological approach to literacy development. Ecological perspectives have also been applied to supporting families and parental involvement in education (Seginer, 2006; Swick & Williams, 2006). Further examples include research of Brown and Low (2008), who discuss the *ecology* of economic disadvantage (as associated with educational disadvantage) and the various factors contributing to it, including chaotic living conditions and irregular sleep patterns.

It is generally agreed that learning should be viewed as a complex, interactive and dynamic process. This has been well recognised in an Irish context by the early education researchers (Hayes et al., 1997; Hayes, 2004). The authors of Siolta, the National Quality Framework for Early Childhood Education (CECDE, 2007a) recognise the inter-dependent nature of the elements that contribute to a comprehensive framework for quality practice, and to a child's development and learning. They recognise, for instance, that the role of the adult in a child's development is shaped by the environment in which this child/adult interaction takes place. The recognition that the relationships occur in context is in agreement with ecological approaches. Hayes (2004) who adopted bio-ecological model of development consistent with ecological systems theory adds that 'a systems approach to understanding child development within the dynamism of an early learning environment provides the teacher with a set of connected elements forming a working whole, it requires attention, not only to

the elements themselves, but also to the connectedness of those elements and the mechanism, the interactions, for such connections' (p. 255-256).

Another recent example from an Irish context is an Irish National Economic and Social Forum (NESF) report on literacy (2009). The NESF report (2009) views literacy development in a holistic way and, in accordance with ecological model, it recognises the importance of simultaneous efforts directed at literacy development at both school and community levels across a lifespan. The roles of parents and communities in developing literacy and numeracy skills in schools have been recognised also in a recent DES publication (DES, 2010) that proposes a draft national plan for improvement of literacy and numeracy in Irish schools.

While the concept 'system' has been appearing recently in education related literature, it lacks in many cases an in-depth exploration offered in this study, representing rather the old mechanism metaphor of a social organisation and not a true *systemic* view. Systems thinking requires seeing the 'wholeness' and going beyond individual levels of analysis (Foster-Fishman & Behrens, 2007). However, it must be emphasised that there is a significant difference between holistic and systemic approaches, with the latter going beyond *both* individualistic and holistic perspectives. According to Bunge (2004), it is systems thinking that can transcend the difficulties of both holism and individualism. As Summers-Effler (2007) observes, the network methods, as in mechanistic models, do not carry such explanatory power as the relational methods. The latter are found in systemic models that include the content of relationships and contexts. What follows is a review of studies that present

systemic perspectives in the education related literature.

2.6 Systemic Approaches in Education

Bronfenbrenner's ecological model, in its extended and re-configured version of bio-ecology of human development (Bronfenbrenner & Morris, 1998) already highlighted the complex dynamic of interactions occurring at all system levels between the person, the context within which he/she is placed, the time, and the content of relationships and contexts. Similar ecological systems theory perspectives have been adopted by those researchers who view development as a dynamic process resembling a web model rather than a ladder model, with one's skills present at various points along various pathways unique to individuals (Mascolo et al., 1998). Thelen & Smith (1998) describe the tradition of dynamic systems theories in child psychology and state:

> All developmental theorists would acknowledge that humans and other living beings can be described over many levels of organisation from the molecular and cellular, through the complex level of neural activity and behavior, and extending to nested relationships with the social and physical environments (e.g., Bronfenbrenner, 1979). And all developmental theories also view these levels as interacting with one another. The deep difference between contextualism and more individual-centered approaches is that the levels are conceptualized as *more* than just interacting; instead, they are seen as integrally fused together. Behaviour and its development are melded as ever-changing sets of *relationships* and the history of those relationships over time. Thus (...) we must discard our notions of simple linear causality: That event A or structure X caused behavior B to appear. Rather, causality is multiply determined over levels and continually changing over time (p.267, italics in original)

Mascolo et al. (1998) propose to view constructivism in a systems

perspective where the construction of any skill or understanding is the result of intersystemic co-actions of bio-genetic, personal, dyadic and cultural processes. They add that in this new systemic perspective 'construction occurs within and between all levels of the person-environment system, from biology through cultural systems. As such, systems metaphors offer exciting new avenues for the development of constructivist theory and practice in education' (p. 49).

Systems theories have been proposed in the psychology of education as a perspective in which to view some school-based intervention programmes (Greene, 2005). Greene (2005), for instance, proposes that a systemic approach can contribute to the understanding of the outcomes of the school-based intervention for pupils with ADHD as it recognises, in contrast to the unidirectional cause-effect model, the multiple forces reciprocally affecting one's behaviour, including strong teacher factors.[34] Greene (2005) proposes that ADHD assessment should be a multimodal systems-based one which involves the assessment of the family and the school factors.[35]

Greene's (2005) argument concurs with a recent proposition of Hawe et al. (2009) to view interventions, including educational interventions, as events in complex ecological systems of social settings (e.g., schools, communities or

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[34] Greene (2005) recognises multiple teacher-related factors affecting efficacy of school-based interventions including attitudes, stress levels, tolerance thresholds, teaching methodologies, job satisfaction, grade preference, etc. He focuses further on two systemic aspects, namely teacher-treatment compatability and pupil-teacher compatability.

[35] An example of systems theory adoption in foreign language teaching is the proposition of Cvetek (2008) to apply chaos theory to the understanding of randomness in classroom teaching. Cvetek (2008) elaborates mainly on the concept of sensitivity to initial conditions, i.e. that a small change can lead to large effect, and demonstrates how this concept, commonly known as butterfly effect, can be adopted to understand some classroom states, e.g., when a pupil's remark can lead to the disorganisation of the class. Cvetek (2008) proposes that foreign language teachers should become 'agents of chaos' and 'chaotize' their classrooms in order to create a new kind of order and new relationships, a proposition he does not explain further. He advocates further that teachers should allow for chaos and unpredictability in planning their lessons instead of engaging in writing lengthy objectives. While Cvetek (2008) states that he adopts chaos theory perspective, his paper lacks an in depth interpretation of its definition, thus representing rather an application of a general systemic *approach* or a combined systems *perspective*, rather than an application of a chaos *theory*.

worksites). Hawe et al. (2009) propose to conceptualise and evaluate interventions as critical events in systems that may either contribute to the emergence of the system's new state, change relationships and transform resources within the system or simply 'wash out' if the dynamic properties of a system are not harnessed. Hawe et al. emphasise after Shiell, Hawe and Gold (2008) that systems thinking and the science of complexity can shift the perspective from the intervention per se to the context or the setting into which the intervention is introduced and with which the intervention interacts (p. 269). This perspective is particularly relevant to the study of SFA.

One example of systems theory application from an Irish context is a recent proposition of Downes (2010) who applies a systemic perspective of concentric relations, implying connectedness, as distinct from diametric relations implying assumed separation, to the understanding and treatment of bullying in schools. Another example of an Irish study is the application of a combined systems theory approach, rooted in Bronfenbrenner (1979) and Capra (1983), to student councils at primary level school by Sharkey (2007). Sharkey (2007) views children's participation in the school decision making process as an organic system with multiple interdependencies and identifies its weaknesses, i.e. inorganic systemic parts that hinder this participation (e.g., weak home-school links). She recognises that systems approaches may not be sufficient to build home-school links and augments her model with citizenship discourse, i.e. raising children's awareness of their position in society, in order to go beyond a current inorganic system in which parents are marginalized.

In an Irish context, Downes and Downes (2007) emphasise the need to develop *living organic* systemic views of education in further depth. They note

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that the systemic approaches in education have been initiated in the Irish context through the emphasis on collaborative, inter-agency approaches to working with young people at risk (Cullen, 1997, 1998; Rourke, 1999). Youth development programmes and youth settings are generally frequently viewed in systemic perspective by international researchers (see Durlak et al., 2007, for meta-analysis of studies relating to systems change in positive youth development programmes; see Behrens & Foster-Fishman, 2007, for an analysis of the relevant articles in the special issue of the *American Journal of Community Psychology* devoted to systems change).

2.6.1 Education as a Living Organic System

Living systems theory is a theory that stemmed from the GST movement (Bertalanffy, 1957) and was developed by Miller (1978). The features of living organic systems have been identified and reiterated by many authors (Bertalanffy, 1957; Bronfenbrenner, 1979; Capra, 1983; Miller, 1978). Living organic systems are characterised by multi-levelled structure with interdependencies, dynamic yet stable nature, uniqueness and self-organisation in the form of self-renewal and self-transcendence, openness, flexibility and plasticity. These are the features that Capra (1983) cites as the ones that differentiate organic systems from machines. Living organisms are in a constant process of growing; they are not stagnant. In their process of self-organisation, which creates its multi-levelled structure, they remain open to interactions with their environment. It is in fact this process of constant interaction with the environment that enables the system to maintain its self-organisation state. There is an exchange of energy between and among the living organisms that creates a

sense of dynamism, namely non-equilibrium (Capra, 1983).

In an Irish context, the living organic systemic view of education has been developed by Downes (1993), Zappone (2002) and Downes and Downes (2007). Zappone (2002) and Downes and Downes (2007) propose to develop a concept of education as a living system in a response to going 'beyond a 'deficit' model for working class communities' (Downes & Downes, 2007, p. 25). The need to go beyond the deficit model of disadvantage is one of the most important themes in an Irish publication 'Beyond Educational Disadvantage' (2007), a book that attempts to present a holistic view of educational disadvantage. Interdisciplinary contributions in this publication attempt to go beyond the artificial barriers between health and education sectors/systems, which is necessary in for example discussions about language and literacy difficulties.

Downes (1993) and Downes and Downes (2007) cite multi-levelled structure with a high degree of non-equilibrium as one of key characteristics of the organic education system. This multi-levelled structure implies necessary relations between its parts, which, in the context of education, Downes and Downes (2007) specify as relationships and further as feedback relationships. One aspect of these relationships is the whole-part relation, what Capra (1983) calls 'holonic', with dependencies in both directions, i.e. 'an integrative tendency to function as part of the larger whole and a self-assertive tendency to preserve its individual autonomy (...) In a healthy system – an individual, a society or an ecosystem – there is a balance between integration and self-assertion' (p. 27). In their analogy between a living organic system and an educational system, Downes and Downes (2007) highlight that 'a static unchanging school or institutional culture is an inorganic system' (p. 32).

While applying the concept of a living organic system to education, it is crucial to recognise that, firstly, living systems are 'alive' (Zappone, 2002, p. 41). This almost tautological statement is an important one to make as it generates a *positive* view of a system. Downes and Downes (2007) say 'systems theory involves a positive focus and enquiry into alienation as an imbalance within the system' (p. 30). 'Alienation' is a concept that Downes and Downes (2007) apply to their interpretation of educational disadvantage. They propose that systems theory can become relevant in understanding the concept of alienation that results from being 'processed' into a dead, inorganic, imbalanced educational system. The work by Downes and Downes (2007) develops the living organic system as a response to 'alienation' that characterises inorganic systems and constitutes an attempt to develop living systems theory that involves going beyond a conception of the 'pedagogy of the processed'.

Downes and Downes (2007) call for 'restoration of an imbalance or alienation' and the need to 'overcome Cartesian fragmentation' (p. 25), through the adaptation of the holistic, systemic view of education. Such a holistic perspective may involve for instance redirecting the focus from individual teachers to the school as a whole (Hylan, 2002, p. 90-91).[36] In accepting the school as a system, one must not forget that each individual classroom constitutes a sub-system with the teacher being both the subject and the object of this system (Downes & Downes, 2007). When it comes to *language* learning, the classroom microsystem seems to be somewhat more relevant than the school microsystem. Despite some standardization of pre-service and in-service education of teachers and the curriculum, one cannot overlook the fact that each

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[36] However, a holistic focus does not imply ignoring the parts. In the SFA study, it is important to focus on individual teachers as key-players in the classroom microsystem.

classroom is unique and self-regulates its climate and teaching/learning processes.

Pedagogy of the processed into an inorganic system

'Alienation', an important theme for Downes and Downes (2007), is described by them as a feature of an inorganic system that occurs where subject-object relationships are inverted, i.e. where the subject becomes reified into an object. This occurs for instance when the teacher is a *transmitter* of the knowledge *into* the pupils, i.e. when the knowledge 'is deposited' into the pupils. Downes and Downes (2007) state:

> Freire's (1972, p. 48) 'banking' model of education drew inspiration from Fromm's distinction between a 'having' and 'being' mode of experience. Thus Freire criticised the alienation within an objectified 'having' mode of knowledge where 'education... becomes and act of depositing'. The teacher is the depositor and pupils the passive depositories of an 'alienated and alienating verbosity' (p. 45) and knowledge is a gift bestowed by those who consider themselves knowledgeable upon those who they consider to know nothing (p. 45). This inversion of the subject-object relation in alienation can occur in methods of teaching where the knowledge and curriculum 'has' or consumes the person, rather than being constructed around the needs and culture of the learner. A related subject-object inversion is exemplified within an authoritarian school system where the pupil is to be passive, inert and de-individualised (p. 27).

Downes and Downes (2007) observe that 'the pupil is alienated through being processed into an inorganic system' (p. 28). In their 'pedagogy of the processed' the pupils are 'processed' into and out of the system, while the teachers are both 'processing' their 'pupils' and being 'processed' into and out of the system. Downes and Downes (2007) imply that the awareness of being involved in this 'pedagogy of the processed', i.e. the mere perception, has a

potential to bring about important changes for the system. 'Curricular content at post-primary level, (...) initial and in-service training of teachers at primary, secondary and third level' are some of the areas quoted by Downes and Downes (2007) as likely to be changed once the 'pedagogy of the processed' concept is understood. This would imply that if the teacher understands that he/she may be the 'processor' and the 'processed', it may influence positively the classroom climate and introduce more learner centred as opposed to content centred teaching. For example, it may result in less reliance on workbooks in the classrooms.

The above may be particularly relevant to classrooms where the pupils are not encouraged to speak, either directly in situations when the teacher requires silence while reading the story until the story is completed, or indirectly, when the teacher's teaching method does not encourage the pupils to speak in longer sentences. 'Talking' may have an unintentional negative connotation in many schools, where the pupils are encouraged to put their fingers on the lips while walking in the corridor, where they receive reward stickers for 'being quiet' and where the adjectives 'good' and 'quiet' are uttered often together in praise.

2.7 Functioning of SFA in a Complex Classroom System

SFA is a unique intervention in the way that while being a whole classroom intervention it attends to each individual in the class without possibilities of exclusion. At the same time however, SFA may be considered an extra-individual intervention as it does not target specific individuals but by changing the acoustics of the classroom, it brings a change to the whole

classroom system. Rosenberg et al. (1999) quote Ross (1995) who stated 'SFA helps all of the pupils some of the time and some of the pupils all of the time' (p. 2).

Even though SFA is not conceptualized as a systemic intervention at its introduction, it should not be considered an external variable that modifies the system. Once installed in the classroom, it becomes an inherent part of the systemic structure, participating in influencing and modifying its elements. All elements of the system co-operate and co-evolve with SFA, including the pupil, the teacher, the classroom and even the school. Hardy (2001) notes that each system strives to maintain its internal organisation and can be changed by an external variable only if the change was meant to happen within its organisation anyway. In this perspective, SFA needs to be considered as an internal element of the system. If the system resists SFA, SFA becomes an external part and its potential to change the system decreases.

It is worth reiterating that SFA is not intended to be a systemic intervention as it targets only one sub-system, namely the microsystem of the classroom. Moreover, SFA targets only one specific dimension crucial for the development of language, namely the listening channel. While language is learnt through listening, it is the frequency of opportunities for *formulation of* language that is necessary for it to develop. Foster-Fishman et al. (2007) note that intervention in only one part of the system can bring the desired outcomes only if concurrent changes occur in other parts of the system. They emphasise however that the intervention does not have to target all system parts but that in order for the intervention to work in one of the parts, the other system parts need to work well.

The complex dynamics of multi-level webs has implications for the validity of interventions introduced in the school context, or in fact in any non-clinical setting. As Downes (2007) observes, the recognition of a presence of supporting background conditions that contribute to the efficacy of the 'cause' was acknowledged already by Mill (1872), and reiterated by for example Rutter (1985). Foster-Fishman et al. (2007) state: 'Of course, effective systems change efforts do not always mean concurrent actions at multiple system level. What is of importance to the systems change agent is the *alignment* of critical system parts with the desired end state' (p. 204, italics in original). Thus, from this perspective, it is necessary to emphasise that SFA is likely to bring minimal or no benefits if other factors, such as for instance the quality of teaching and stable family situation, are not met. As a system part, SFA influences system parts and is influenced by system parts, its character within the system differs in different subsystems and among different system actors (Foster-Fishman et al., 2007). In other words, SFA works somewhat differently in each classroom.

In understanding the functioning of SFA in the classroom, it is helpful to follow Tseng and Seidman's (2007) argument that resources are insufficient to bring about a change in the system without 'healthy' working social processes. SFA can be considered a resource; its power is insufficient on its own. It needs to be linked with social processes, for example, with good quality teaching.[37] However, even though SFA targets only one system part, by amplifying the teaching instruction, it has the potential to radiate change to many levels. Foster-Fishman et al. (2007) and Foster-Fishman and Behrens (2007) emphasise that interventions should focus on system parts that are most likely to have multiple

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[37] As a consequence of the fact that SFA amplifies 'teaching', this thesis will focus on teaching in many parts

connections with other system parts. If we consider that some children may not hear the teacher well, by improving the listening channel, SFA has the potential to open up a range of contributing factors related to teacher instruction that might not have been available to these children. Durlak et al. (2007), in their meta-analysis of studies presenting systems change in youth programmes, define systemic change as 'attempts to change the roles, behaviours, and relationships among members of one or more social systems' (p. 272). According to this definition, SFA may be considered a systemic intervention as it has the potential to change the behaviour of the pupils in the class and perhaps even the roles of the teachers.

The focus on both the teachers and the pupils in this study is also dictated by the requirements of a microsystemic analysis, in which it is crucial to analyse the interactions and reciprocal relations between the participants of the system.[38] The behaviour of one person cannot be observed in isolation from the other persons' behaviour. Bronfenbrenner (1979) terms it 'second order effect' when the behaviour of a person is affected by another person in a system. For instance, if a teacher changes his/her behaviour, this will have an impact on the pupil's behaviour and vice versa. If the pupil's behaviour changes so will the teacher's. Other examples include situations when a teacher-child dialogue is affected by another child speaking out of turn, or an SNA helping the child.

In agreement with current constructivist perspectives, there is no one classroom 'reality' in which SFA is creating a particular effect into which a researcher has an access. The effect of SFA in the classroom cannot be known directly, but it can only be captured or rather perceived from a web of

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[38] The videotaping of the whole class allowed for thorough analyses of the interactions in each classroom as well as for revisiting these analyses.

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behaviours and relations that are observed. Its effect is thus fluid and changing, just like the fluid nature of language whose 'level' also cannot be simply captured, though standardised tests attempt to capture it on a certain continuum. The predicted effect of SFA in the classroom can be constructed as an outcome/condition of a simultaneous presence of a set of elements known to positively affect language development. The actual effect of SFA in each classroom is constructed within a complex dynamics of system elements present in the classroom at a time of observation. Furthermore, the effect of SFA is constructed differently by each pupil due to his/her unique system elements. To understand these constructions is one of the purposes of this thesis.

2.8 Classrooms and Schools as Complex Social Webs

Classrooms and schools are examples of complex social webs. Multi-level social webs comprise cognitive systems and various simultaneous processes interacting between them. Hardy (2001) identifies the following properties of multidimensional complex social systems: inter-influences and creative agency, fuzzy organising factors and goal-directedness, multi-level synergy and feedback, web-like environment and co-evolution, emergent self-organisation and global reorganisation and multi self-reference (see below for an elaboration on these features in relation to the educational system and SFA).

There are inter-influences between every creative agent in the web, i.e. each pupil in a class influences the other pupils and the teacher, being at the same time influenced by the other pupils and the teacher. These influences depend on for example the setting of the classroom or the type of grouping in the

classroom. For instance, a pupil may be distracted by another child or may decide not to participate in a discussion because another child may call out the answers. In complex systems that Strevens (2005) terms 'nondecomposable' systems, the behaviour of one systemic component cannot be understood in separation from other systemic components. In such systems, the system dynamics are determined by interactions between system parts, which despite being strongly interactive are at the same time strongly independent.

2.8.1 Fuzzy Organising Factors

Schools and classrooms do not have a strict organisational structure. Although they do follow a certain pattern and are governed by the goals they plan to achieve and the contextual constraints, each school and each classroom is different and unique. The uniqueness of each classroom is a result of the diversity of pupils and teachers and the relationships between them, as well as the larger ecosystem that each class is embedded in, with multiple differences in school climate and out-of-class level of support.

Classrooms are open systems with a complex order as they exchange matter and information with their environment, i.e. the parents, the school and the community. However, they remain self-referential meaning that they regulate their own structures. Schwarz (2007) observed a sort of a paradox of self-regulating systems that are both open on an existential plane and closed on a logical and physical plane. This may be relevant to classrooms as these may be perceived as in fact autonomous and logically operating without external links, i.e. physically closed. However, as Luhmann (1995b) observes, self-reference is

only possible with reference to the environment and in the context of an environment:

> (...) self-reference can only exist in an environment and only in relation to an environment. Or, with a different expression, that self-referential operations and system/environment differences mutually imply – and even more: logically imply – each other (p. 5).

Schwarz (2007) noted another apparent paradox of self-referential systems, namely that on the one hand autonomous systems become compatible and coherent with their environment, and on the other hand systems are egocentric in preserving their autonomy, which may define their interactions with the environment as perturbations. Classrooms are thus influenced by the school, with classroom climate and teacher's perceived self-efficacy (Bandura, 1997) being two examples of features potentially influenced by the school climate.

2.8.2 Multi-level Synergy and Feedback

The study of cybernetics that focuses on circular relations introduces the concepts of positive and negative feedback loops, negative feedback loops being the stabilizing ones and positive feedback loops being the diverging ones. Complex systems are characterised by these feedback loops (or closed loops), i.e. clusters of closed relationships, which are of particular importance in *living* systems. Hardy (2001) describes the mechanism of feedback loops in the following words: 'Information about the current state of a fluctuating system is fed back to a control-system in order to adjust the variables generating the state' (2001, p. 50). Feedback loops are conceptually of higher importance than the

variables creating them as they can affect the variables (variables may 'belong' to a few loops at the same time) (Hirsh et al., 2007).

An example of a feedback loop in the SFA study may be the child's responsiveness that is affected by the teacher's question (i.e. type of obligation) that in turn is a function of the teacher's perception of the child's linguistic ability. In this system, a change in one variable creating a loop generates a change in the whole loop by affecting another variable in either a positive or negative way (Hirsh et al., 2007).[39] For example, the more familiar the teacher's question is to the pupil, the higher is the pupil's responsiveness and conversely, the less familiar is the teacher's question, the lower is the pupil's responsiveness.

Circularity, the central concept of cybernetics, characterises the teacher-pupil relations; however one may note that it does not characterise the SFA-pupil relations per se as SFA, although an element of the classroom *dynamics*, is merely a static element of the classroom, and as such cannot be modified. Some circularity notions may be applicable to SFA if one takes a more systemic perspective that by modifying the teacher's teaching, SFA affects the pupil, and the pupil's behaviour in turn modifies the teaching. SFA may thus be considered a *starting* point for circularity of teacher-pupil relations.

Feedback would not be possible without co-operation between sub-systems, which is another feature of multi-level webs (Hardy, 2001). Co-operation means that each sub-system co-evolves with other sub-systems. This feature may be absent at certain levels of educational system relevant to language, for example when parents, teachers and speech and language

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[39] Hirsh et al. (2007) explain further that there are two types of loops, namely balancing and reinforcing loops. Balancing loops bring the system back to its balance/its status quo, while reinforcing loops amplify the change in any given variable (Hirsh et al., 2007, p. 242).

therapists are not working together. Many community-based speech and language therapists provide therapy outside the school context and do not co-operate with school-based language support teachers in planning and implementing language interventions. This is one example of a gap between health and education sectors that was highlighted by the authors of 'Beyond Educational Disadvantage' (2007) and that needs to be bridged in the domain of language.

2.8.3 Self-transcendence in Organic Classrooms and Schools

The various dynamic processes in which living organisms are engaged include self-renewal, homeostasis, healing, adaptation, self-transformation and self-transcendence (Capra, 1983, p. 309). Organisms grow, self-transform themselves, go beyond themselves to create new layers of complexity, what Capra (1983) calls 'creative unfolding' (p. 310). This may explain why the system may suddenly and unexpectedly move to a different state or create a sub-system within itself (Parson, 2007). Hardy (2001) identifies creative self-organisation and self-reference as important features of complex multi-level webs. She notes that self-organisation in a system takes place through inter-influences. These in turn may act as change amplifiers.

Downes and Downes (2007) note that 'change amplifiers must be operative throughout the entire organism if they are to effect self-transcendent change. They involve an interplay between *both* bottom up and top down forces for change' (p. 32, italics in original). This applied to education would imply that a number of changes must occur on its various levels, e.g., pre-service and in-service of teachers, classrooms and schools, before any visible/perceptible

transformation occurs. In this perspective, SFA and in fact any intervention is only one part of a complex system. There needs to be many processes co-evolving simultaneously for a change to happen. For a pupil, for instance, there needs to be a number of different factors present for a maximum learning to take place, including good quality of teaching, stable family situation, good attendance *and* good classroom acoustics.

Self-transcendence and self-regulation of complex webs are constrained by so-called organising factors (Hardy, 2001), which are mostly created by past experiences. The analysis of the organising factors seems to be particularly relevant to education. Some of the constraints in education that apply to the teaching of language include the allocation of curriculum hours for language and, in some cases, teachers' low expectations of pupils from designated disadvantaged areas (Eivers et al., 2004; 2006). Another constraint on the self-regulation is that living systems, despite their interactions with the environment, maintain their internal organisation and their optimal state (Hardy, 2001, p. 53). Hardy (2001) adds, however, in a positive tone 'I believe it is more productive to emphasise our capacities for change. It seems obvious that groups are able to voluntarily change their organisation, on the basis of a chosen strategy' (p. 40).

Another aspect of self-organisation of complex systems identified by Hardy (2001) is what she calls *emergent self-organisation,* which is the creation of new order or new pattern in a system due to interaction of different forces and constant modifications of the system's sub-parts. Hardy (2001) emphasises however that we 'must allow for a definite influence (albeit not a command) of the environment on the system's state, bringing about a continuous modification of evolution of the system' (p. 55). This implies that an educational system can

evolve, *if* it remains open. This openness includes also openness to research projects including those utilising classroom observations, openness of the classroom to the parents in, for instance, infant classes and openness of the classroom to a speech and language therapist. Hardy (2001) proposes that forces driving from the environment should be treated as internal forces, i.e. forces 'acting *within* the web' (p. 55) and not as 'an input into the system' (p. 55).

2.9 Going beyond Simple Linear Interpretations of the Efficacy of SFA

As there are numerous forces interacting in a multi-level web, one cannot predict with certainty the future of the web, including the outcome of the intervention. Self-organisation or global reorganisation may occur in response to an event that could not be predicted. For instance, if a child experiences some personal problems during the intervention phase, the predicted effect of the intervention on this child is likely to be modified. The principle of equifinality, namely that systems may achieve similar end states even if their initial states are very different, was observed by Bertalanffy (1967), the father of the general concept of a system, as a feature present in open systems and specifically in organic systems. This non-proportionality of input and output (or cause and effect), resulting in for instance small input but large effect or vice versa, may be of particular applicability in classroom intervention research.

Parsons (2007) notices that 'logic models' presenting predictable cause-effect relationships may be useful for studying only short-term and stable parts of the system but that dynamic non-linearity must be taken into account in analysing *complex* systems. Arguments against linearity seem to be multiple,

particularly when it comes to the study of language, as language is neither acquired in a linear way nor can it be ordered in any linear way. Though traditionally, the speech and language therapy field presented a hierarchy of language as a phoneme-morpheme-syntax pyramid, current approaches to language recognise its complex multidimensionality and the inseparability of its components. Furthermore, as radical constructivism suggests, when it comes to language and communication, it is constraints rather than causes one needs to consider (Glasersfeld, 1992).

Many system theorists emphasise the interrelationships between the systemic parts and while doing so, they look for multiple cause-effect relationships. Foster-Fishman et al. (2007) note, for example, that it is important to identify the complex pattern of interaction between systemic parts in order to identify the 'root cause' of a particular systemic state. Kreger et al. (2007) use the logic of dichotomous thinking when they say that '*cause and effect* are not necessarily close in time or space and may be affected by multiple other systems or subsystems' (p. 303; italics not in original). The process of looking for a 'root cause' is in direct opposition with the proposition of Hardy (2001) who emphasises the need to go beyond causality, a concept that strongly pervades our way of thinking, but which shows the 'influence the mechanistic paradigm had had on our way of thinking for more than three centuries' (p. 47). Hardy adds (2001) 'We are all too prone to equate lawfulness and regularity with causality'. Interventionists working in education, or in fact, in any other complex system, need to be aware of this and not to attribute a change in behaviour *solely* to the intervention. This relates also to the evaluation of the SFA. Hardy (2001) warns us against confusing 'causality with the very concept of explanation' (p. 48).

While interpreting the benefits of SFA, a number of factors contributing to possible changes in pupils' linguistic behaviour will be analysed, together with the context within which this intervention is operating. While Palmer's (1998) study, as the only found SFA study, applied an ecological perspective to the evaluation of SFA benefits, her ecological approach did not inform the conceptualisation of SFA as an educational intervention. Palmer (1998) predicted that some elements of the classroom may mediate the effect of SFA. She observed three elements of the classroom, namely task type, activity type and classroom structure, however, adopted a cluster approach to the analysis of these findings and simply compared the baseline and the intervention data, concluding no substantial differences between them. Thus, while an ecological perspective is present in Palmer's study design, the *conceptualisation* of SFA in her study still conforms to the simple linear relation of one-antecedent-one-consequence. Moreover, the ecological approach in Palmer's study seems to be actually utilised to augment the logic of simple linearity.

One cannot attribute any improvements in linguistic behaviour to a single cause, e.g., solely to SFA, without analysing the system which this cause is brought into. Such thinking in terms of simple linearity underlined most reports presenting the benefits of SFA to date (Allen & Patton, 1990; Brophy & Ayukawa, 1999; Flexer et al., 1994; Massie & Dillon, 2006a; Massie & Dillon, 2006b; Rubin et al., 2007; Sarff et al., 1980). Those reports, some of them very well controlled studies, presented 'improvements' in behaviour and attributed those solely to SFA, equating simple causality with explanation. However, to understand complex social events, one must adopt complex causality, rather than

a simple one-antecedent-one-consequence equation. Further critique of one antecedent-one-consequence relation is presented below.

2.10 Adopting Systems Theory to Studying Intervention Efficacy

Continued research on SFA, conforming to a simple causal model, supported the claim of the efficacy of SFA for different populations and for different aspects of development. However, this large body of research has failed to bring more knowledge and more meaning about the context for this intervention. While a design involving empirical research, consistent with behaviourism, and previous SFA studies, is chosen in this thesis, systemic perspectives are introduced as crucial to the *understanding* of SFA. System elements provide conditions for SFA efficacy, i.e. they may either support its efficacy or negate the expected positive effect of SFA.

Gergen (1982) cites Quine (1953)[40] and Duhem (1906) who argue that one must recognise the existence of infinite and largely unstated auxiliary hypotheses that need to be met in order for any one hypothesis to show true value. This view recognises that negative results do not necessarily fault the articulated hypothesis (Gergen, 1982, p. 8), but that some background conditions (hypotheses) might have hindered the expected outcomes. While the discussion of *all* conditions necessary for SFA 'to work' is beyond the capabilities of empirical research, this thesis will explore key elements of the classroom that support the efficacy of SFA. In other words, it is argued that a system creates

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[40] Quine (1953) introduced a concept of auxiliary hypotheses present along with a main hypothesis.

conditions for analysing how to improve the efficacy of SFA. Systems theory

thus *augments* the knowledge gained in previous SFA evaluations.

While the behaviourist model is frequently associated with the narrow

linear relation of one-antecedent-one-consequence (utilised in most previous

SFA studies), the model, as Zuriff (1985) argues, was rarely in agreement with

major behaviourist theories. Zuriff (1985) notes that while some behaviourists

conform to the assertion that behavior consists of responses caused by *eliciting*

stimuli, many more argue for a notion of behavior and environment reciprocally

determining each other. He recognises that the environment can affect the

organism in many ways beyond the simple stimuli and that there is a reciprocal

relationship between the two. Zuriff (1985) recognises also that the context in

which a behavior occurs includes other responses and stimuli occurring in the

spatial and temporal vicinity, as well as causes of the behavior present in the

organism, when he says that 'the consequence of a stimulus is not fixed' (p.

103). He concludes that 'behaviour is a resultant of *multiple* forces' (p. 103,

italics not in original). Thelen & Smith (1998) in their discussion on intellectual

heritage of dynamic systems theory cite a psychologist and embryologist Kuo,

who already in 1970 recognised the dynamic nature of behaviour:

> Thus, in every stage of ontogenesis, every response is determined not
> only by the stimuli or stimulating objects, but also by the total
> environmental context, the status of anatomical structures and their
> functional capacities, the physiological (biochemical and biophysical)
> condition, and the developmental history up to that stage (Kuo, 1970,
> p. 189).

Further, Rachlin (1984), another behaviourist, critiqued this simple linearity

frequently associated with behaviourism:

It would seem to be an important task for psychology to determine what the (overt behavioural) criteria are for the use of mental terms, how they change with circumstances, how they interact with one another. Before doing this job, it may be necessary to widen the conception of the operant, as originally advanced by Skinner, from a single discrete event (such as a lever press) to a complex pattern of events that may occur over days and weeks and (consequently) to alter the notion of reinforcement from contiguity between a pair of discrete events (response and reward) to more complex correlations that have meaning only over an extended period. (p. 567)

Both Zuriff (1985) and Rachlin (1994) note that Skinner's introduction of the concept of discriminative stimulus (as opposed to *eliciting* stimulus) and his focus on reinforcement already dispenses with the simple linear model of one-antecedent-one- consequence. Teleological behaviourism as presented by Rachlin (1994) embraces past, future and current behaviour of an organism, thus modifying the simple antecedent and consequence linearity.[41] It expands a model of a single event dependent on a single operant to an 'overlapping pattern of operants' (Rachlin, 1994, p. 32), with operants serving as a context for behaviour. Furthermore, Rachlin (1994) adds that 'a given act may be truly understood only some time, perhaps a considerable time, after it occurs because the context (the final cause) of an act extends into the future as well as into the past' (p. 32). Rachlin (1984; 1994) thus recognises that in principle the context of the behaviour is infinite.

Gergen (1982) modifies further the one-antecedent-one-consequence relation when he observes that 'in any case, at the human level, the bond between stimulus conditions and subsequent response appears *indeterminant*' (p.

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[41] Teleological behaviourism is concerned with a less familiar form of causation, namely final causation, as opposed to a more familiar efficient causation. Rachlin observed that the wider concept of cause was already present in Aristotle's writings that present four types of causes: material, formal, efficient and final, all relevant in explaining the motion of physical objects.

15, italics not in original). Gergen thus views human beings as open systems who are 'stimulus free' in their ability to interpret the meaning of a stimulus, i.e. to repattern stimuli in their construction of experience (this capacity of the organism explains for example differing responses to a given stimulus over time). In other words, one's potential reactions to any stimulus are related to the context of one's experience and are thus subject to alterations over time. Gergen thus recognises that, firstly, there are alternative means for achieving a given end and, secondly, that there are alternative ends that may be reached through any given means (p. 19). This perspective is consistent with systems sciences, and specifically the concept of equifinality.

It is recognised that the application of systems theory to the evaluation of SFA complicates the inclusion of this thesis within traditional science. Systems theory cannot be proved wrong according to Popper's (1959) falsification theory, implying an infinite complexity of sub-systems and their elements while being able to present only simplified models within the constraints of its language. While classroom observations are a research tool capable of proving that SFA *may not work* in the absence of any language improvements, they cannot prove that SFA *may work* as there could be multiple other factors simultaneously contributing to the development of language. Most importantly however, the assumption that SFA is a contributing factor supporting the development of language cannot be falsified. It is not possible to prove that SFA may *not* be one of the supporting factors, in other words, that the development would have occurred without the presence of SFA. It is thus crucial to emphasise that this thesis does *not* follow traditional positivist science in which falsifibility is a key requirement.

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One must note, however, that the application of systems theory to SFA evaluation has a greater explanatory power than any hypotheses on SFA without its application. This is due to the fact that systems theory is capable of explaining why SFA can bring benefits to some classes and not to others and to some pupils and not to others within the same class. This explanatory power somewhat challenges previous approaches to SFA. Interestingly, a majority of previous SFA studies did not find many examples of the diversity in intervention outcomes on individual research participants, i.e. of non-proportionality and of equifinality, most likely due to their cluster sample approaches.[42]

2.11 Conclusion

A majority of previous SFA evaluations presented a model of SFA within a simple causal relation of one-antecedent-one-consequence, a model that was already critiqued within behaviourism (Rachlin, 1984; Zuriff, 1985). Systems theory was introduced and elaborated in this chapter as a theory that has a potential to bring more meaning to the *understanding* of SFA efficacy. Following a suggestion of Downes and Downes (2007), organic systems perspectives relevant to education and to the SFA in the classroom context were developed in further depth, where classrooms and schools were seen as complex multi-level webs, and SFA as an element introduced into them. Thus, it was argued that the SFA effect can be 'enabled' only if certain other conditions in a system are met, i.e. if other system parts are aligned with the desired outcome of this intervention. Bronfenbrenner's ecological model, as one that introduces a

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[42] Mendel et al. (2009) noted higher gains in one of the studied classroom while Eriks-Brophy & Ayukawa (2000) found that one student's on-task behaviour decreased following SFA installation.

holistic perspective and a classification of the elements of the complex classroom microsystem, thus supporting the observation of this microsystem, was chosen to augment this combined systems theory perspective.

CHAPTER THREE

This chapter details methodological approaches adopted in this thesis. It consists of nine subsections. The first and second sections present the design of the study and the profile of its participants. Section three presents the details of standardised language assessment conducted in the study while sections four, five and six present the management of the dynamic assessment that included a range of language dimensions observed in the classrooms. Measurement of changes in the teachers' behaviour and the lessons' content that contributed to the observation of each classroom microsystem are included in section seven. The final two parts of this chapter report on the ethical considerations, the coding of the research data and the study limitations.

Methodology

3.1 Study Design

The multi-method design of the study included a multiple baseline pre-intervention phase (A) and an intervention phase (B) case study design, combined with pre-intervention and post-intervention standardised tests administration. Children from 14 classes were observed (videotaped) in their classroom microsystems for the duration of at least one school year, 3-5 times before the introduction of intervention (A) and 5-17 times after the introduction of

intervention (B). The intervention phase (B), which was much longer than the pre-intervention phase, was segmented into sub-phases (B1, B2, B3). The rationale behind this segmentation was to observe potential developmental patterns relating to maturation effects of irreversible behaviours (that were not expected to change with the withdrawal of intervention, e.g., the use of complex sentences) in the absence of a non-intervention 'control group'.

Case study is an appropriate method of measuring such highly variable behaviours as language (Kazdin, 1982). It allows one to document variation and carry out an in depth analysis. Most importantly, it tends to take a holistic perspective, examining bounded systems in the context of their environments. Conducted with larger groups, it allows for generalisability of findings across settings and individuals. Case study as a method of measuring the impact of sound field amplification was introduced by Palmer (1998), who evaluated its benefits for behaviour in the context of an American classroom. Prior to the commencement of this study, the benefits of SFA for the development of *language* were not evaluated either in Ireland or internationally in a case study design.

Following Bronfenbrenner (1979), the importance of developmental validity in research is recognised in this study. Developmental validity refers to the situation where change in behaviour is carried over to another setting, so the development is not only situation or setting specific. If a change occurs at different times and in different settings, one can say that the result is valid. Bronfenbrenner (1979) cites Weisz (1978) and Parke (1979) who argue that good scientific studies should conduct the experiments both in ecologically valid, naturalistic contexts and controlled laboratory contexts, in order to produce transcontextual validity. To ensure this validity, classroom observations, carried out systematically with the

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inclusion of a variety of lessons, were supplemented by standardised tests. It can be argued that SFA can be considered beneficial if the gains are observed both in the classroom and in standardised test performance.

This thesis utilizes thus both dynamic and static methods of language assessments. It is recognised in this study that the individual's language level may be different in the classroom and different in clinical conditions. It is thus considered that dynamic assessment in only one context may be insufficient to determine the child's language level as in some classrooms children may not be able to present their full linguistic potential. The limitations of a static assessment that is not accompanied by a dynamic one have been raised by various researchers (Fagundes et al., 1998; Lund, 1996; Scott, 1995). Another dimension of developmental validity is that the child may behave differently in the classroom if there have been changes in roles, relations and activities at home (Bronfennbrenner, 1979, p. 103). This will be referred to in individual case studies, where relevant and known. It may also be applicable to understanding some unexplainable patterns of data.

While conceptualising an input of an intervention in a system, one may take either a deductive or inductive approach or a combination of both to naming the variables of the system (Foster-Fishman & Behrens, 2007). In other words, the variables may be taken from the literature or expert opinion or they may be observed in a given system, i.e. deduced from the data given, or both. Hirsh et al. (2007) say 'Model building may rely on in-depth review of existing empirical and theoretical literature, collection of new qualitative and quantitative data, secondary data analyses, or on experiences and opinions of people who are close to the process of interest' (p. 245). In this SFA study, the presented variables are the

results of a combination of the researcher's observations and knowledge, quantitative and qualitative data gathered from classroom observations, and the literature.

The study was intended to bring benefits to all participating children, regardless of their language developmental levels prior to the intervention and regardless of their areas of linguistic strength and weakness, their gender and their first language. The children participating in the study created a heterogeneous group. Providing for this heterogeneity, a range of language dimensions commonly studied in SLT literature and combining in a wide linguistic profile of each participant was identified. The variety of language dimensions used was intended to identify the strengths and weaknesses of individual pupils before and after the introduction of the intervention and present language as a continuum involving norm-referenced scores. The criteria relating to language difficulties were individualised, i.e. the performance of each study participant was assessed individually, through participation in the classroom context and in a normative comparison on standardised tests of language.

3.1.1 Classroom Observations

The participants of the study were observed *systematically* both before and after the intervention in their naturalistic setting (i.e. the classroom), where the actual development transpires, to arrive at a pattern of their activity from which their development can be inferred. This methodological approach allows for the

systemic analysis of the SFA and is directly relevant to the theoretical framework of the intervention (Durlak et al., 2007).[43]

A few previous authors who studied SFA, mostly those who examined the effects of SFA on attention and classroom behaviour, utilised classroom observations as a research method (Eriks-Brophy & Ayukawa, 2000; Maag & Anderson, 2006; 2007; Palmer, 1998; Ryan, 2007). Classroom observations allow the observation of teacher's behaviours such as reinforcing and the promotion of certain pupil behaviours in the classroom. They allow a focus on the studied culture and thus constitute a method of assessing culturally and linguistically diverse populations (Pena et al., 1993).

The recognition that a systems change is a process and not just an end-state (Foster-Fishman et al., 2007) further adds to the rationale for continuous observations of language behaviour of each participant. It is recognised that SFA may influence the classroom environment in one way at the start of the study and in a different way at the end of the study, when pupils and teachers become firstly accustomed to it and secondly when the teachers may have acquired a certain awareness about the importance of language.

Classroom observations were used as a supplementary evaluation method in some previous language-related studies (Laing & Kamhi, 2003; Lund, 1993; Ukrainetz et al., 2000). Observations of interactions with familiar persons and in familiar settings are ecologically valid in the context of language assessment, while standardised tests allow for judgment on the presence of potential language impairment. Standardised test results alone were considered insufficient to

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[43] Bronfenbrenner (1979) considers observation of individuals in their naturalistic and immediate setting still insufficient, saying that the analysis must broaden the perspective even further and involve settings that are beyond the immediate ones, i.e. the analysis of 'a multi-person systems of interactions' (p. 21), something which was beyond the scope of this study.

determine a child's language needs due to socio-cultural, situational and linguistic biases (Craig & Washington, 2000). Norm-referenced assessment was, however, needed in order to determine potential language difficulty as dynamic assessment is insufficient to determine its presence (McCauley & Swischer, 1984; Olswang & Bain, 1996). It was also recognised that the child's linguistic ability to perform in naturalistic situation is more important than his/her ability to perform in clinical conditions (Wittmann, 1998). Overall, it was intended to obtain language samples:

- With a familiar interlocutor (teacher rather than researcher)

- In a familiar setting (classroom rather than separate room)[44]

- From more than a single time performance (at least two observed lessons).

The observations of the context and the interactions in each classroom microsystem were conducted together with the observations of the language behaviours of the study participants. The analysis comprised of several categories related to the classroom context, the teacher-child interactions and the children's language behaviours. The coding process was based on the categories of presence/absence and frequency/non-frequency of occurrence of the observed phenomena. Recording sheets, reporting on these aspects, were devised and completed on the basis of lesson transcripts, field notes and revisiting of video recordings. Two research assistants who lived in the area of the studied population were employed to review the accuracy of lesson transcripts. Disagreements were resolved by consensus. The following table 1 presents the categories of the process and the context data that were measured in the study.

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[44] Time constraints were an additional (secondary) reason for not collecting language samples in one-to-one dialogic exchange. A 10-minute language sample is usually transcribed in 2 hours and coded in a further 1 hour (Adams, et al., 2006).

Table 1 Analytical framework of the study: Observed elements of the system

Classroom context (Observed for the class)	Interactions (Observed for the class and for each study participant)	Language behaviours (Observed for each study participant)
Number of children present during each recording session (Quantitative data used for judgment on size of the class	Teacher's use of open-ended questions (Frequent/Not frequent)	Participation
Size of the room (Observed at the start of the study/ inter-observer agreement)	Was expository discourse enabled in the class? (Yes/No)	Responsiveness
Teacher's use of SFA on the day the researcher arrived for recording session (Quantitative data used for judgment on the intensity of intervention)	Teacher's use of language stimulation techniques (incl. language modelling, expanding, extending, recasting, evaluating) (Frequent/Not frequent)	Syntactic complexity
Subject of the lesson recorded	Were the elements of dialogic story reading present? (Yes/No – Frequent/Not frequent)	Loquacity
Other observations (e.g., new behaviour management system/ SNA present in the class, etc.)	Were the power relations shifted towards the children? (Yes/No)	Pragmatic appropriateness
	Other observations (e.g. relating to the style of teaching, whether or not children were given choices, etc.)	Grammatical correctness

3.2 Sampling Approach and the Participants' Profile

In selecting participating schools and classes, criterion sampling (Patton, 1990) by a) geographic area, b) disadvantage status and c) age of children was used. School principals from 8 schools in the SSP programme under DEIS[45] in two geographical areas in Dublin were asked to select one junior infant class, one senior

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[45] Delivering Equality of Opportunity in Schools (DEIS) (2005); SSP – School Support Programme (see Glossary).

infant class and one first class in their schools for participation in the study. The school principals selected the classes on the basis of teacher willingness to participate in the study.

Five children with speech/language difficulties were selected by their teachers from each class. Teachers were asked to identify in their classes five children who:

- were experiencing speech and/or language difficulties

- may have been at risk of developing speech and/or language difficulties.[46]

A similar culturally and linguistically unbiased dynamic assessment method that compares language skills of an individual to the language of his/her peers was recommended by Stockman (1996) who developed a concept of Minimal Competency Core, i.e. minimal language competency that is achieved by *a majority* of the individuals in the relevant population. Other studies proved that teachers' judgment is consistent with speech/language therapists' diagnoses (Segebart & Watkins, 2001) and that they can accurately predict later academic achievement (Archer & Edwards, 1982). However, some researchers observed that teachers can predict high achieving pupils better than they can predict low achieving pupils (Demaray & Elliott, 1998).

As children were referred for participation in the study by their class teachers, there was no purposive sampling in terms of gender balance. Males constituted 60% of the total number of participants (39 out of 65) while females constituted 40% (26 out of 65). Twenty eight per cent of study participants (18 out

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[46] The teachers were given further directions as to how to identify children with language difficulties *only* if they asked for these. The majority of teachers participating in this study were comfortable identifying children with language difficulties, based on their observations and knowledge and supported by their experience of referring children to SLT services or for additional language resource hours in school.

of 65) received auxiliary educational support[47] in a one-to-one setting within their

school, such as: learning support, resource hours or Reading Recovery. Among the

studied group, there were 6 international children (9%) for whom English was an

additional language (EAL). [48] Three different age groups were selected: junior

infants, senior infants and first class (children aged 4-7) (see appendix B for age of

the participants at the start of the study). The intervention was introduced either at

the start of the school year (in November 2005) or at the end of the school year (in

May 2005) in junior and senior infants and at the start of the school year (in

November 2005) in first classes.

There were 14 classes from 7 schools in two geographical areas in Dublin

participating in the study. While three classes from each school were approached

to take part in the study, i.e. junior infants, senior infants and first classes, it was

not possible to observe all of them in all schools. This was mostly due to time

constraints of the researcher at the start of the study and to a lack of one school's

consent to videotape the lessons. The fourteen classes were chosen randomly on

the basis of convenience at the start of the research.

In schools, a class level analysis was conducted for all study participants. A

combination of criterion and purposeful sampling to enable an in-depth analysis of

cases was used to select a smaller sample of pupils (Yin, 1994). First classes were

excluded from case-study level analysis. This criterion of grade level was

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[47] Additional programmes that were implemented within the classroom, and not on a withdrawal basis, were not considered under this quantification. For example, in one school an hour of intensive literacy instruction was delivered to the whole class by the teacher and two additional staff members for an hour every day.

[48] There were two children in the sample who belonged to culturally and linguistically diverse (CLD) groups (African English speakers). CLD children perform better when tested on processing-dependent subtests (e.g., Recalling Sentences subtest, Concepts and Directions subtest) than when tested on subtests that require prior knowledge and experience (e.g., Formulating Labels subtest) and it is the processing-dependent measures that they should be assessed on in order to determine language impairment (Campbell et al., 1997; Laing & Kamhi, 2003). This was considered while interpreting the results of individual children and is presented in case studies in chapter four, where relevant.

consistent with findings of some previous SFA reports that noted its greater benefits for younger children (Flexer, 1989; 1992; Mendel et al., 2003). Detailed case studies of the pupils from junior and senior infant classes are presented in the following chapter.[49] This detailed level of analysis excludes one class of senior infants where the teacher was observed not to wear the microphone on *all* occasions when the researcher visited the school, including two days when the microphone was not charged, and one junior infant class where the teacher was observed to wear the microphone on 2 out of 5 days the researcher visited the school. Detailed scores for these classes are presented in appendices M-O and S.

Not many children identified by the teachers as experiencing speech and language difficulties exhibited articulation and phonological difficulties (just 4 participants[50]) although in general there are large numbers of children in whom difficulties of language co-occur with speech difficulties (Yavas, 1991). Since a significant majority of children who were referred for participation in this study exhibited age-appropriate phonological processes, e.g., non-adult production of a fricative ʃ as in 'ship' or a phoneme 'r' at age 4 (norm: Dodd, 2006), it was assumed that they would follow the normative speech development trajectory with or without intervention. Thus, the focus of this study was on language, and not speech, acquisition.[51]

While attention was paid to analysis of children's language on a range of language dimensions, some aspects of language were not analysed. This study does not look at phonological development and language dimensions related to

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[49] Data available for participants from first classes can be seen in Appendices B-G, M-O and S.
[50] Another participant, whose speech was occasionally unintelligible had a diagnosis of shortened frenum and awaited minor surgery aiming to correct it.

[51] Speech difficulties, if present, were noted as a variable in case studies of individual children. They were, however, not quantified (no formal assessment of speech was implemented) but presented descriptively.

fluency, as well as some more specific aspects of language pragmatics, such as coherence.[52] Semantics was not assessed in naturalistic settings and that was partly due to insufficient linguistic material available for semantic analysis. The focus of analysis in this thesis was the SFA's contribution to language dimensions that are directly relevant to academic achievement, as argued later on in this chapter, and that might need a longer exposure to this intervention, as opposed to the aspects of speech perception or spelling that can be predicted to show an immediate effect of SFA. The dimensions studied were: participation, responsiveness, syntactic complexity, loquacity, pragmatic appropriateness, grammatical correctness, norm-referenced expressive language, norm-referenced receptive language and norm-referenced receptive vocabulary. These dimensions will be discussed in more detail later in this chapter (see figure 1 below for a summary of dimensions).

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[52] However, a dimension of pragmatic appropriateness, analysed in this study, has a potential to combine various aspects of the pragmatic aspect of language crucial in a dialogue, such as coherence and topic maintenance.

Figure 1 Language dimensions analysed in the study

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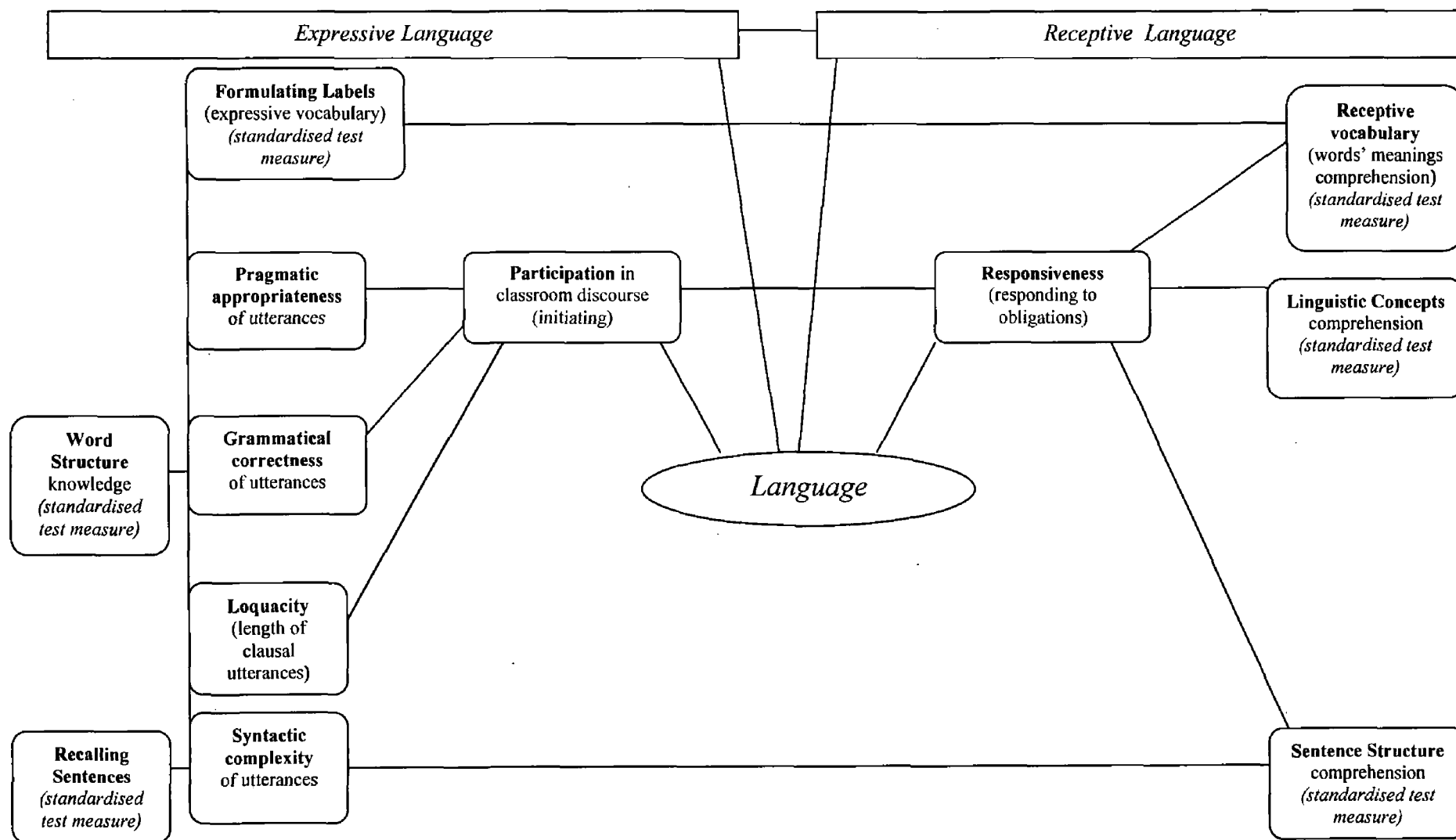
3.3 Standardised Tests

Standardised tests assessing language abilities were administered to all study participants.

3.3.1 Choice of Tests

Three tests were used: Clinical Evaluation of Language Fundamentals – Revised UK (CELF-3UK), Clinical Evaluation of Language Fundamentals – Preschool (CELF-P) and British Picture Vocabulary Scale II (BPVS-II). The CELF is a standardised language test most widely used by Irish, British and American speech and language therapists and recommended by the Irish Association of Speech and Language Therapists (IASLT). It evaluates both expression and comprehension (see below for details) and it has very good reliability (Wiig et al., 1992; Semel et al., 2000). A vocabulary test was chosen as vocabulary can be a good predictor of success in school (Dunn et al., 1997) and picture-based vocabulary tests are usually quick and easy to use. The British Picture Vocabulary Scale II (BPVS-II) evaluates receptive vocabulary.

There were thus three language dimensions measured by standardised tests:

- Expressive language (measured by CELF Expressive language component)

- Receptive language (measured by CELF Receptive language component)

- Receptive vocabulary (measured by BPVS-II).

3.3.2 Sample

Participating children were selected to be tested on at least one language dimension: expressive language, receptive language and/or receptive vocabulary. The children were selected for standardised testing according to the following criteria:

- Availability of testing space

- Variation of dimensions

- Availability of time

Availability of testing space

The room provided for testing guided the decision on choice of the test. This related to the absence of distractions (e.g., no other children/adults in the room). If there were some distractions, a shorter test that allows for repetition of stimuli sentences was administered. The BPVS-II test is a short test and it allows for repetition of a stimulus, while during the administration of CELF-P Expressive Language, a story is told to the child and no repetitions of stimuli sentences are allowed.

Variation of dimensions

An effort was made to assess each child on at least two different dimensions. That is, children were randomly selected to have either receptive and expressive vocabulary tests paired (BPVS-II paired with CELF-P Expressive language test which included Formulating Labels subtest assessing expressive vocabulary) or

receptive and expressive language tests paired (CELF Expressive language and CELF Receptive Language paired)

Availability of time

Some children were tested on one dimension only, if the time allocated for testing did not allow for administration of two tests. Each child was tested on one language dimension at a time. There was a time gap of at least one day between the administration of the second test. The order of tests' administration was random. Overall,

- 32 children were tested for receptive vocabulary on BPVS-II

- 42 children were tested for receptive language (comprehension) on CELF, three of whom were EAL children.

- 34 children were tested for expressive language on CELF, four of whom were EAL children.

3.3.3 Time and Place of Test Administration

Dynamic assessment was preceded by static assessment (Olswang & Bain, 1996), with the exception of one class (class A). Children from this class were observed before they were tested on standardised tests. This modification to the usual sequence of assessment was needed because of the time constraints during the baseline data collection at the beginning of the study. Children from class A were tested on standardised tests in the first week of the intervention phase.

Tests were administered in rooms free of distraction and audio recorded. Rooms were organised for testing by each of the 7 participating schools. In the case of two schools, it was not always possible to obtain a quiet room. One school

requested that children be tested at the back of another classroom. Another school accommodated the researcher in a resource room, together with a resource teacher working at the other end of the room. Testing conditions were replicated at post-intervention assessment.

Standardised tests were administered according to the Examiner manual - that is, the stimulus was not repeated if the manual did not allow for that. No feedback was given. The BPVS-II Manual (Dunn et al., 1997) estimates that the time required for this test is between 5-8 minutes (p. 7). The CELF-Preschool Manual (Wiig et al., 1992) estimates that the time required for the full test administration, i.e. both expressive and receptive language components, ranges between 30-44 minutes, depending on the age of the child (Wiig et al., 1992, p. 4). The CELF-3 Examiner's Manual (Semel et al., 2000) estimates that the full administration time is 30-45 minutes (p. 8). The above estimates exclude the time taken to establish rapport with the child, possible breaks between the subtests and possible dialogue after the test administration. In order to make the testing situation less threatening, each testing session started with a conversation and children were allowed to comment on pictures throughout the test if they wished. This extended the average time of administration.

3.3.4 Details of Tests

The Clinical Evaluation of Language Fundamentals (CELF) was used to evaluate strengths and weaknesses in language expression and language comprehension. The CELF evaluates sub-domains of language such as: morphology (word structure), syntax (sentence structure), auditory memory (ability to recall) and aspects of semantics (vocabulary and word meaning).

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Two versions of CELF were used: CELF-3UK and CELF-Preschool.[53]

CELF-Preschool is designed to assess children aged 3.00-6.11 and CELF-3UK is

designed to asses children and young people aged 6.00-21.11 (Semel et al., 2000;

Wiig et al., 1992). Both of these tests place performance on the same underlying

scale. The majority of children participating in the study were assessed with CELF-

Preschool as they were below 7 years of age. Children who reached the age of 7

were assessed with CELF-3UK. Because the study lasted almost 2 years, some

children, who were assessed pre-intervention with CELF-Preschool had to be

reassessed post-intervention with CELF-3UK (31% on receptive language and 24%

on expressive language). For expressive language, there were 26 children retested

on the same version of CELF and 8 children retested on a different version of

CELF. For receptive language, there were 29 children retested on the same version

of CELF and 13 children retested on a different version of CELF.

A few children (n=3) who participated in the study were assessed post-

intervention by a clinician from local speech and language therapy services (i.e. a

part-time school-based speech and language therapist). The results of those

assessments were disclosed to the researcher (parental consents were obtained to

allow for disclosure of any assessment results). Those initial assessments of

eligibility for speech and language services were treated as final assessments of the

present study. School-based SLT used the newest version of CELF, namely CELF-

Preschool 2, which was published only in the second year of the study. The

majority of individual subtests of CELF-Preschool 2 and CELF-Preschool (all but

one) are correlated and details are shown in appendix I. All versions of CELF:

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[53] After the commencement of this study, the CELF-Preschool version was standardised on British children (CELF-P was originally standardised in an American context) and another version of CELF: CELF-Preschool 2 was designed. Three children were assessed with CELF-Preschool 2 post-intervention. Those were the children who were assessed by a school-based speech/language therapist.

CELF-Preschool, CELF-Preschool 2 and CELF-3UK, assess receptive and expressive language. There are six subtests, three for expressive language and three for receptive language in each version[54] (appendix H provides description of each subtest administration).

Another test administered to study participants was the British Picture Vocabulary Scale II (BPVS-II). BPVS-II is an easy, fairly enjoyable picture-based test that does not require extended testing time. The child is presented with four pictures at a time, the examiner reads a stimulus word and the child is then required to point to the picture of that word. This test does not place huge demands on working memory and it does not require strong meta-linguistic skills (as other language tests that evaluate specific language domains, e.g., word structure).

3.3.5 Data Analysis: Standardised Tests

At interpretation of pre- and post-intervention test results, a 68% confidence interval (a score range that gives one 68% confidence that the child's true score would be in that range) was considered suitable for identifying the child's linguistic strengths and weaknesses (Wiig et al., 2004). Differences of 1 standardised point between pre- and post-intervention standardised tests' results were considered insufficient to be called either increases or decreases and, if they occurred, a 'no change' finding was noted. Increases by 2 or more standardised points were called either 'probable gains' if they were within the 68% confidence interval or 'clear gains' if they were greater than the 68% confidence interval.

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[54] CELF-Preschool 2 introduces a concept of the Core Language, in which expressive and receptive language are not initially separated unless a child presents with some delays and more detailed assessment is needed. Individual subtests scores can be obtained in both CELF-P and CELF-P2. Most CELF-P2 subtests correlate to CELF-P subtests. Details on differences are quoted where relevant.

Standardised tests' results were interpreted together with classroom observations for each individual. Group analyses of individual classes were also conducted. Intervention programmes may have a different effect on children who performed very well at baseline compared with children who were less able at baseline and who may be more dependent upon the intervention (McCartney, 1999). Thus, the efficacy of the intervention in the present study was evaluated separately for children who performed better at baseline and for those who were less able at baseline: a group including children with potential language impairments of a severe type (i.e. more than 2 standard deviations below the mean). Grouping participants of intervention programmes according to their baseline ability was also used in other studies (Bickford-Smith, et al., 2005).

3.4 Dynamic Assessment: Data Collection

3.4.1 Video Recordings

There were 173 lessons observed, each of 30 minutes duration. All of the observed lessons were videotaped by the researcher. Palmer (1998) recommended using video recordings to measure changes in performance across many lessons while evaluating the benefits of the sound field amplification system. Videotaping has not been used by previous SFA researchers to date. Each class was recorded 3-5 times before the introduction of the intervention and 5-17 times after the introduction of the intervention for 30 minutes per recording session. Some children were absent during some recordings, which reduced the number of data points in individual cases, but each child was recorded on average 3.5 times before the introduction of the intervention (SD=0.62, range: 2-5) and on average 9.0 times

after the introduction of the intervention (SD=3.14, range: 5-17). The mean number of all data points per class was 12.0 (range: 8-21, SD=3.2)

Lessons were videoed systematically, both pre-intervention and post-intervention. An extended period of adaptation after the installation of the sound field was not found necessary by other SFA researchers who reported immediate change in behaviour (Jones et al., 1989; Zabel & Taylor, 1993; Palmer, 1998). There was an eight week time period after the summer time holiday during which no video recordings were taken to allow the children to settle down in classes. All teachers knew in advance when the researcher would be coming to video record the class. This was likely to imply what is often termed a Hawthorne effect (Landsberger, 1958), i.e. to have some implications for the behaviour of the observed pupils and teachers, an important factor that will be elaborated on further in the final chapter of this thesis. Such notice was requested by the teachers.

3.4.2 Lesson Content

Teachers were asked to introduce 'any lesson that will generate talking'. The videoed lessons presented a curriculum area of the teacher's choice, except that all teachers were advised to *definitely not* introduce Irish lessons and to *rather not* introduce mathematics lessons. Those who looked for more specific guidelines were encouraged to introduce language lessons and were given the example of 'story time'. The request to 'rather not' introduce mathematics lessons was directed in order to gain linguistic material rich in clausal utterances.[55] It is recognised that mathematics teaching and learning may produce discourse rich in clausal

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[55] A clause utterance is an utterance with a subject and a predicate and any number of modifiers (see Glossary).

utterances; however, the experience of the researcher was that these lessons usually generate fewer clausal utterances with fewer modifiers than language arts lessons.

'In the junior primary classes, assessment (of oral language) will often occur in conjunction with specific oral language activities that are organised during English classes' (Shiel, 2000, p. 252). In fact, a significant majority of the observed lessons were English language lessons with a significant majority within them being story time activities. A small number of lessons represented other curriculum subjects, e.g., religion or Social, Personal & Health Education, while a few lessons were drama lessons. Elements of mathematics instruction occurred in some classes. Some lessons did not invite syntactically complex structures and some invited mostly word level responses. These incorporated phonics activities (e.g., *What sound does this letter make?*), phonological awareness activities (e.g., *What are the words that start with 's'?*) and word recognition activities (e.g., *Who can read that word?*).

3.4.3 Lesson Format

Teachers were asked to introduce whole class lessons. In such teacher-led settings the turn taking is conducted by the teacher and the teacher either directs questions to the whole class or calls on individual pupils to respond. The choice of this class format for the videotaping sessions was 'a compromise' as the whole class format is not considered to be the most effective setting pedagogically, particularly in an early childhood education setting (e.g., Burns & Myhill, 2004; Hayes, 2004; Siraj-Blatchford, et al., 2002). However, it must be emphasised that the class size in schools with a disadvantaged status (DEIS) in Ireland is reduced. The average number of children participating in the observed lessons was 15, with

many classes having fewer than 14 pupils present at any one time, and some but significantly fewer lessons having 20 or more children present at any one time.

The functioning of groups in the classroom depends on the teacher's ability to group the pupils in such a way that they interact with each other. Galton et al. (1980) argue that interaction is more likely to occur in mixed-ability grouping. As five children identified by their teachers as experiencing speech and language difficulties were observed in each class, it was decided that a whole class format would substantially reduce the time spent on recording each class. Additionally, in a whole class format, all targeted children could be recorded simultaneously and all their utterances could be recorded clearly.

The variability of language with its high dependence on contexts was a crucial part of the rationale for observing lessons in the whole class format. Language productivity, language complexity and some pragmatic aspects of language such as turn-taking have been found to vary significantly for children with language impairments, depending on the context, for example, whether the child is in a peer play session or a small group lesson (Peets, 2009). Furthermore, Fagundes et al. (1998) noted that task variability might affect the production of complex sentences for linguistically and culturally diverse populations to a larger extent than it may affect a mainstream population. Introducing a similar participation structure (teacher-led) was thus crucial to reduce the many variables that affect language. By introducing uniform teacher-led lessons, the following variables were minimised (Shiel, 2000, p. 247):

- The nature of the audience and the listener (participating in a group situation)

- The composition of the group in which the pupil works (whole class).

Overall, the request to introduce whole class format was directed in order to:

- Reduce some of the variables affecting language

- Maximise the sound quality of the recordings

- Minimise the time spent on recordings (in favour of both the researcher and the teachers).

It is crucial to emphasise that the whole class format was used for collection of linguistic data and that there was no assumption of causal attribution between language gains and teaching in a whole class format. Whole class teaching may not constitute an ideal context for use of a range of strategies identified in the literature as supporting the development of language, such as modelling and discourse enabling strategies, although many teachers can successfully use these strategies during whole class format lessons, particularly in groups of approximately 15 pupils, which was the average size of the observed lessons.[56]

While linguistic data for the purpose of this thesis was collected in a whole class format, it is recognised that SFA has a potential to introduce more favourable learning conditions in both whole class and other teaching modes (i.e. group and individual work). Signal-to-noise ratio during group work deteriorates markedly in comparison to whole class format and may decrease even to a negative value (i.e. noise louder than teacher's voice) (Larsen & Blair, 2008). Furthermore, the microphones provided to each class can be used in other ways than the obvious amplification of the teacher's voice during whole class teaching. Some SFA researchers acknowledge potential benefits of 'pass around' microphones in enhancing children's self-esteem in speaking (Flexer, 2002), however, no empirical studies researching such use of SFA in the classroom were found.

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[56] See further chapters for elaboration on individual teachers' quality of teaching.

Maintaining the same lesson format was considered crucial while analysing for a participation dimension (see glossary). However, maintaining teacher-led lessons for 30 minutes was found to be 'difficult' by some teachers, particularly in junior infant classes. The teacher-led time varied for each recording and ranged from the whole 30 minutes to the minimum of 15 minutes for some recordings. Recordings within each class were compared to each other and the longest period of time during which the whole class format was introduced across all recordings was segmented for each class, e.g., in class M there were 4 recordings with 30-minute teacher-led lessons, and the remaining recordings with 27-minute, 21-minute, 23-minute, 22-minute and 24-minute whole class lessons. The time period during which the *participation* dimension was analysed in this class was 20 minutes, i.e. the longest minimum time (rounded). Table 2 presents the time period during which participation was analysed in individual classes.

Table 2 Time period during which
participation was analysed for
individual classes

Class code	Time
C	15mins
E	15mins
B	15mins
A	15mins
D	20mins
M	20mins
L	20mins
F	20mins
O	20mins
K	20mins
H	25mins
J	25mins
N	30mins
G	30mins

Other dimensions, i.e. responsiveness, loquacity, syntactic complexity, grammatical correctness and pragmatic appropriateness, were analysed from 30 minutes of recording.

3.4.4 Transcription Process

All recorded lessons were transcribed orthographically[57], verbatim. The lessons were transcribed selectively, as follows:

- All verbal utterances, non-verbal responses and occurrences of 'hand up' by children participating in the study

- All teachers' questions directed to the whole class and all teachers' obligations directed to the observed children, as well as the teachers' feedback directed to the children participating in the study

The utterances of other children in the class were *not* transcribed. Lessons were firstly transcribed from the video and then checked and supplemented with the recordings from the tape (lessons were recorded using both video camera and a mini disk recording device with an omni-directional microphone).[58] Two people who were living in the area of the studied population were employed to review the accuracy of transcripts where doubts occurred. Disagreements were resolved by consensus. Transcripts were then analysed on a range of dimensions which will be outlined below. The same researcher coded all the data by hand and thus internal consistency was maintained.

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[57] Orthographic relates to written words and indicates the use of conventional spelling.
[58] Total time spent on transcription of a 30-minute lesson varied and ranged from 100 minutes to 210 minutes, depending on the class loquacity level.

3.5 Dynamic Assessment: Data Management

3.5.1 Dimensional Model

Providing for the diversity of the studied sample and the complexity of language, a dimensional model for analysis was chosen. A combination of inductive and deductive approaches was applied. In other words, dimensions were derived from the literature on the communication impairments science (inductive approach) and a number of those were identified after transcription as most characteristic for the studied sample (deductive approach). The dimensions chosen were: responsiveness, participation, loquacity and syntactic complexity, grammatical (syntactic and morphological) correctness and pragmatic appropriateness (appropriateness and adequacy).

Thus, in addition to the dimensions typically studied in the SLT field such as loquacity, syntactic complexity and grammatical correctness (see Lund, 1993, for a review), less structural dimensions such as responsiveness and pragmatic appropriateness of children's utterances were chosen. Responsiveness and pragmatic appropriateness of children's utterances have received increased interest in the SLT field since the late 80s. They are currently considered to be important contributors to building children's communicative profiles (Adams et al., 2006).

Some of the measures were qualitatively defined conversational indices (responsiveness, pragmatic appropriateness) and some were more quantitative in nature (syntactic complexity, loquacity, participation, grammatical correctness). This range of language dimensions was chosen to provide a wide language profile of each study participant. Figure 1 on page 113 summarises language dimensions

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analysed in this thesis, while figure 2 on page134 provides an outline of the elements of language that were coded for each study participant.

The frequency of occurrence of specific language behaviours (e.g., the number of times a child responded to obligation, relative to the number of all obligations he/she received) or the proportions of specific language behaviours in the language sample (e.g., the proportion of complex sentences in the total number of sentences) were used as outcome measures. Such quantification, in which the occurrence of a child-specific behaviour is coded and the proportions of linguistic behaviours are computed from language samples, has been used in various previous international studies (Adams, 2006; Curenton & Justice, 2004; Haley, et al., 1994; Scott, 1995).

Some dimensions related to all children (e.g., participation) but some dimensions were typical only for specific children (e.g., pragmatic appropriateness or responsiveness). For example, when a child responded to all of the teacher's obligations during the baseline observations, his/her responsiveness was of no concern. There were no expectations of future gains placed on children who obtained a maximum possible score in the baseline. However, all children were observed on all dimensions, both the ones that were their strengths and the ones that were their weaknesses, throughout the duration of the study.

In some cases, the scores were not possible to obtain due to insufficient linguistic material (e.g., the absence of clause utterances) or the absence of certain communicative features (e.g., teacher's obligations) necessary for computation of scores. For example, if a child did not receive any obligations from the teacher during the baseline observations, a responsiveness score could not be established. Similarly, if a child produced only single word and phrase utterances, his/her

loquacity score (i.e. the proportion of multi-clausal utterances in all clause utterances) and syntactic complexity score (i.e. the proportion of complex sentences in all sentences) could not be evaluated.

3.5.2 Segmentation into Phases

The baseline phase consisted of either 3 or 4 recording sessions, with exceptionally 2 or 5 recording sessions. The recordings after the introduction of the intervention were divided into 2 or 4 phases (depending on their number), with also 2-5 recordings in each phase. Thus the study presented 3-5 phases for each class, i.e. the baseline phase (A), 1st intervention phase (B1), 2nd intervention phase (B2), 3rd intervention phase (B3) and, for one class only, 4th intervention phase (B4). The mean number of recorded lessons (data points) per phase was 3.5 (range: 2-5, SD=0.74)

While segmenting recordings after the introduction of the intervention into phases, the following criteria were applied (in order of importance) (see appendix K):

- The length of exposure to intervention

- The wealth of linguistic material available (recorded)

- The number of recorded lessons.

3.5.3 Responses and Utterances: Segmentation and Classification

There were two levels of transcript analysis:

- The structural level of *utterance* (syntactic complexity, grammatical correctness)

- The broader level of communication with *response* as a unit of analysis (loquacity, responsiveness, pragmatic appropriateness and participation).

Response was defined as any contribution that was generally relevant to classroom discussion. Similar definitions of response appeared in previous studies (Burka & Jones, 1979, Gillam et al., 1999). One response equalled one conversational turn (e.g., *He is only joking/He is not going to eat it* or *I think I know where he got his temper from/Because maybe he wanted to go to the carnival but his ma wouldn't let him*), even if it contained more than two clause utterances (more than two sentences). Responses were coded on two further levels according to processing demands placed (Merritt & Cullatta, 1998):

- Single word/phrase responses and clause responses

- Word level and text level responses

Single word and phrase responses were mostly responses that related to the lowest level of perceptual distance[59] (level I and II in Preschool Language Assessment Instrument: PLAI[60]) (Fagundes et al., 1998) where language matches perception and involves mostly labeling, descriptions of people and objects and more rarely actions. Children may provide a sentence response on this level (e.g., *What is this? – That's Goldilocks; Where did they go? – They went to the beach*), depending on their language development levels, but they most often provide a

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[59] Termed also 'semantic displacement' (Bradshaw et al., 1998).

[60] PLAI distinguishes 4 levels of perceptual distance in language. The higher the level, the more cognitive processes (interpretation) it engages. There are 4 levels of abstraction in PLAI: Matching, Analysis, Reordering and Reasoning, respectively. Matching is when the child's response matches closely verbal and perceptual information (e.g. *What is this?*). Analysis is when a child is required to identify and/or combine perceptual information (e.g. *What is she doing in that picture?*). Reordering is when a child is required to reduce and/or reorder perceptual information (e.g. *How are these the same?*). Reasoning is when a child is required to predict the events or justify ideas (e.g. *Why do you think that?*) (Blank et al., 1978).

single word response (*Goldilocks*) or a phrase response (*To the beach*). There are many questions that test the child's knowledge within this category (Girolametto et al., 2000) (e.g., *What color is this? – Red; What is the name of this person? – Dentist; What month are we in? – September*). Clause responses were mostly responses to open-ended questions. These usually involved some degree of interpretation (e.g., *What do you think he is going to do; What happened at the beginning?*). Most self-initiated relevant contributions were also clause responses.

The density of single word/single phrase responses to the total number of verbal responses was quantified for each participant, for each phase of the study (see appendix E). This quantification was useful for interpreting the results. A higher percentage of word level responses is likely to result in a lower percentage of grammatically incorrect and pragmatically inappropriate responses and it may also impact on participation and responsiveness, as many word level responses require specific knowledge. For example, a child is less likely to produce a grammatically incorrect or pragmatically inappropriate response when producing a single word or phrase than when providing a longer (clausal) response. The number of clausal responses produced by a child can be an estimated indicator of the lesson content and the teacher questioning method to some extent (see appendix D). Research has found that children who are perceived by teachers as lower-ability pupils also receive more closed questions and fewer open-ended questions (Hargreaves, 1984). However, linking clause density solely to the lesson content and the teacher's stimulus should be treated with caution for the following reasons:

- Self-initiated contributions are likely to be clause responses,

- Some children may choose to participate in word level tasks only or, less likely, in text level tasks only (e.g., participate in phonics lessons and not in class discussions, or vice versa),

- The child can make some closed questions open, if she/he elaborates in responding to them (Hargreaves, 1984) (e.g., *Was the bear scary? – He didn't seem scary),*

- Children may provide pragmatically inappropriate responses in the form of single words or phrases to open-ended questions that require sentences (e.g., *What do you think happens when the storms are made? - Windy*).

The number of clause utterances produced by a child, on the other hand, is also an estimated indicator of the child's linguistic development. Children experiencing language difficulties use fewer syntactically complex forms and generally produce fewer clauses per conversational turn (see Scott, 1995, for a review). Density of clausal utterances was used frequently as a measure of a child's language development in the literature on communication impairments science (also in language analysis software: e.g., Miller & Chapman, 2000). However, this was mostly in play situations, during which a child takes a lead and where the purpose is to obtain a language sample rich in self-initiated verbalisations. In the context of the classroom, with its thematic restrictions and varying teachers' stimuli, clause density may not reflect the child's true language abilities. Thus, paradoxically, in the present study the number of clausal utterances produced by a child presents itself as both an intervening variable and an outcome measure. This will be noted when interpreting the results.

Word level responses were responses that operated on:

- The phonological level of words
(phonics, phonological awareness tasks: *Tell me an 's' word*)

- The morphological and syntactic level of words
(work with suffixes and prefixes, work with assembling sentences:
Went she shop to, is that correct? Give me an 'ing' word)

- The semantic level of words
(work with opposites: *What is the opposite of 'hard'?*
and explaining word meanings: *What does 'astounding' mean?*)

Word level responses category grouped also:
- Occasional reading and mathematics tasks
(*How many animals can you see in this picture?*)

Word level responses created a subcategory within single word/phrase responses.

Each response was segmented further into utterances. A response can contain one or more utterances. An utterance is a linguistic unit of conversation used widely in the speech and language literature. All verbal contributions made by the targeted children were divided into utterances during the process of transcription. The following presents the criteria that were applied during this process (Lund, 1993):

- A simple sentence (one clause sentence) or a phrase (e.g., noun phrase) or a single word (e.g., *yeah, yesterday*) that constitutes one turn is one utterance;

- Yes/No are separate utterances only if not followed by another clause. Only yes/no utterances that were responses to obligations were coded;

- The end of a sentence is the end of the utterance;

- A complex sentence (multiple clause sentence) joined by a co-ordinating conjunction *(or, but,* with the exception of *and)* is one utterance. If the sentence contains more than two independent compound clauses, it is

segmented so that the third clause, beginning with the conjunction, is a separate utterance (Lund, 1993, p. 223);

- Sentences with subordinate (*I know what else she could eat*) or relative clauses (*I got the presents that I wanted*) are single multi-clausal utterances;

- One contribution could contain more than one utterance.

The following were *not* coded and thus were excluded from analysis:

- Nursery rhymes and songs;

- Whole class repetitions and reading aloud, including reading in chorus from a 'big book' (English, et al., 2002);

- Stereotypical expressions (e.g., *I can't see, Can I go toilet, Look' it*);

- Expressions irrelevant to classroom discussions (e.g., *Teacher my belly is sore*);

- Repairs and subsequent repetitions;[61]

- Unintelligible utterances;

- Spontaneous unfinished attempts to contribute discontinued due to either some external factors, e.g. someone walking in the classroom, or because the child abandoned them;

- Other maze behaviours, e.g., non-linguistic vocalizations, self-repetitions, false starts (Pena, et al., 2006, p. 1041).[62]

Figure 2 below provides an outline of the elements of language that were coded for.

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[61] Repair in speech is a correction/modification or a repetition of content ('false start').
[62] Maze behaviours are dysfluencies in speech, such as repetitions, repairs and false starts.

Figure 2 Elements of language that were coded for each study participant

| Teacher's questions | Teacher's obligations |

| Participation | Responsiveness |

| Pupil Responses |

| Pragmatic appropriateness | Word level utterances |

| Clausal utterances |

| Loquacity |

| Syntactic complexity |

| Grammatical correctness |

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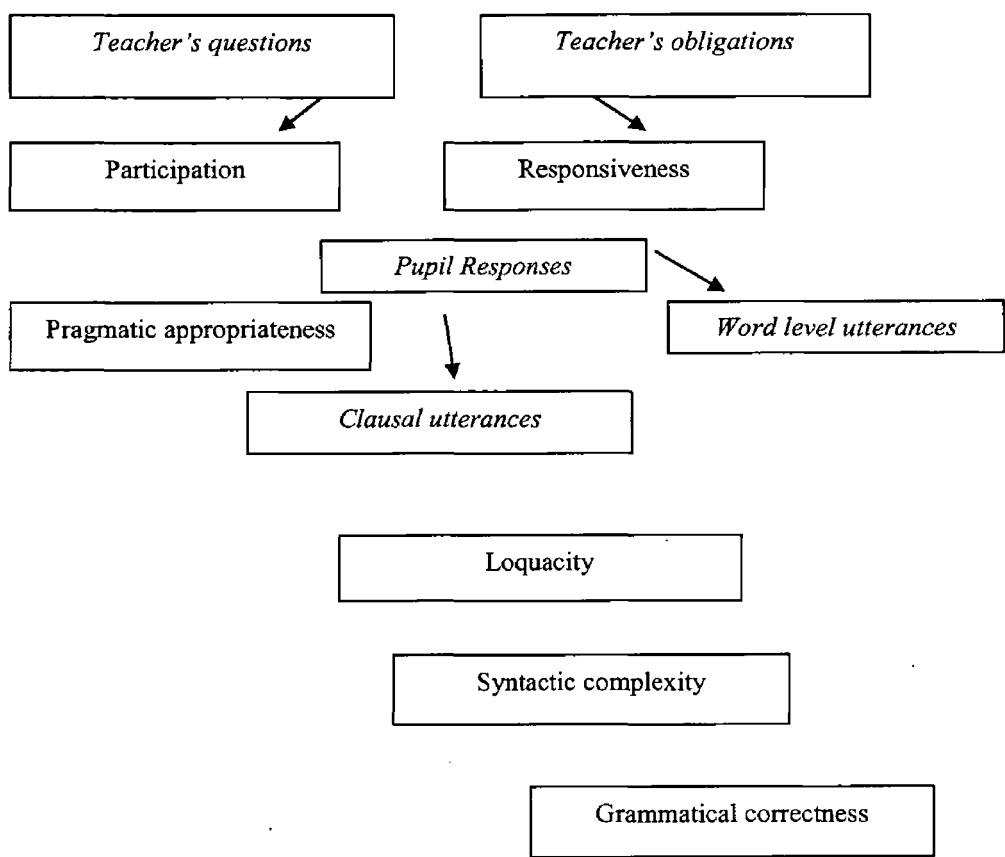
3.6 Dynamic Assessment: Language Dimensions

The following measures were derived from the speech and language literature and some were modified to suit specificity of classroom discourse.

3.6.1 Responsiveness

- *Responsiveness* was defined as the number of 'child's responses' to the number of 'teacher's obligations'

The measure of 'verbal responsiveness' as the number of child responses to the number of obligations he/she receives was used in several previous SLT studies (e.g., Warren, et al., 1984; Fey et al., 1995; Adams et al., 2006). A 'lack of response' was coded when a child was given an opportunity to respond but did not do so within 4 seconds of the obligation. A nonverbal response was *not* coded as a lack of response. Bishop et al. (2000) note that children with language difficulties do not usually choose a nonverbal mode of responding but that the nonverbal model of responding is usually chosen by normally developing but younger children. Thus, in the present study, nonverbal responses were not distinguished from verbal ones but shaking and nodding were coded as 'yes' and 'no' respectively and shrugging was coded as 'don't know'. 'Don't know' could have been in turn coded as a 'pragmatically inappropriate/inadequate response' as in: *What did you do yesterday after school? - I don't know* (Bishop et al., 2000; Adams et al., 2006) (see an elaboration on this below).

Teachers' utterances that solicit acknowledgment and not information (Bishop et al., 2000) were not coded as obligations if children did not respond to

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them. Children, however, did sometimes respond to such solicitations and this corresponds with previous research (Bishop et al., 1998). And if they did so, the acknowledgment soliciting utterances were coded as obligations (and thus responses to them were coded as obligated responses), as in the following example:

Where did you go?

To see elephants

Did you/I am sure you had a great time didn't you?

Yeah and I saw a giraffe as well

3.6.2 Participation

- *Participation* was defined as the total number of combined 'volunteering for response' (HA)[63] and 'not obligated responses' (self-initiated and volunteered responses) to the number of 'teacher's questions' (defined as teacher's solicitations for verbal response).

This dimension was computed in a timeframe that was uniform for all observed lessons (see table 2 on page 125 for the length of time in each class). Measures of verbal discourse participation were used in other SLT studies and are defined as either the number of child utterances to the number of solicitations he/she receives (Adams et al., 2006) or as the number of non-obligated utterances versus obligated ones (Stockman, 1996). These measures were introduced, however, while analysing dyadic exchanges between a child and a tester/SLT and so their character changes when applied to the classroom discourse. Wray &

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[63] This dimension is based on the assumption that a raised hand means 'I want to say something relevant'.

Kumpulainen (2002) note that a majority of the contributions initiated by children in the classroom may be in fact 'oblique' answers to questions posed by the teacher some time earlier. For example, a child saying spontaneously *Look there is Goldilocks* may be responding to a question posed at the beginning of the story time *What can you see in this picture?* Thus, all contributions relevant to classroom discussion, regardless of whether provided spontaneously or after invitation, were coded as 'responses'. The number of non-obligated responses in the classroom could be compared in this perspective to the number of initiations in unrestricted discourse settings (e.g., during free play).

Participation rules vary across different classrooms and they also vary within one classroom across different activities, for both children with learning difficulties and normally developing children (Donahue, 1994, p. 229). Every observed classroom had its own 'rules' and its own pattern of interaction and only a few classes conformed to the traditional Initiation-Response-Feedback model (Sinclair & Coulthard, 1975) (see glossary). There were many spontaneous responses in some classes and a 'free' discussion format lessons in some other classes. Previous international research on classroom discourse identified spontaneous responses (defined in some studies as 'calls out – task related') as a separate category in whole class episodes and distinguished them from responses after invitation ('elicited contributions') (Edwards & Mercer 1993, Myhill, 2002; Fay et al. 2004). Edwards & Mercer (1993) observed that teachers react variously to children's spontaneous contributions, from disapproving and ignoring them to incorporating them into the discourse. This variability was also observed in the present study.

All contributions relevant to the lesson content, both elicited and spontaneous, were taken into account while analysing for participation.

Spontaneous contributions were included in order to avoid the effect of maturation. It is recognised that children learn the rules governing a classroom discourse, including the rule to wait a turn to speak and raise a hand to indicate willingness to contribute, throughout junior infant class. Another reason for inclusion of spontaneous contributions in this dimension was a possible difference in the teachers' and the pupils' conception of what is 'appropriate' behaviour in classroom. Such differences were studied, for instance, in Aboriginal (Inuit) classrooms in Australia in which group participation (spontaneous contributions) format is natural and reprimanded only by non-Inuit teachers (Crago et al., 1997).

The highest score in participation could not be predicted because the children could have provided an unlimited number of relevant responses and because some questions posed by the teachers were list questions (Scarth & Hammersley, 1986), that is questions that elicited more than one answer (e.g., *Give me words beginning with 's'?*). Both volunteering to participate in class discussions without a teacher's specific elicitation and volunteering to answer questions posed to the whole class were measures of verbal participation. The number of teachers' questions (solicitations for verbal response) against which this dimension was measured served as an indicator of the teachers' stimulus and controlled for varying lesson content. For the present study, it was considered crucial that children were observed with the same teacher, as a change in a teacher's questioning style could have confounded participation scores.

Teachers' questions were coded initially into either a fundamental questions category or a follow-up questions category. Both categories were then combined and the participation score was measured against the total number of teachers' questions. Only questions that elicited *verbal* responses were coded, that is

classroom managerial questions (e.g., *Is everybody looking at the book? Why wouldn't you sit closer? Where are you looking now?)* and questions eliciting acknowledgment (e.g., *Was that a nice thing to say? I am sure you had a great time didn't you?)* were *not* coded. A teacher's question in the present study was defined as an utterance that elicited language. The adopted definition placed 'a question' beside a concept of 'an utterance soliciting verbal response' that is frequently coded in studies in the communication impairments' science. The criteria for coding teachers' questions are defined in appendix A.

Inter-coder reliability for coding teachers' questions was computed. A qualified primary school teacher was employed to code teachers' questions in 5% of the recorded material. The author of this thesis trained this teacher in relation to the criteria for coding questions. The results of coding by the teacher and the researcher were compared to each other and inter-coder reliability was computed on the basis of a percentage agreement across questions. Inter-coder reliability for the 5% of the recorded material was very high and equalled 0.94 (i.e. 94% agreement).

3.6.3 Loquacity

- *Loquacity* was defined as the proportion of 'multi-clausal responses' in the total number of 'clausal responses' produced.

Loquacity as a quantification of clause utterances or multi-clause utterances has been measured frequently in previous SLT studies (e.g., Adams, 2006; Pena et al., 2006). In these studies, loquacity was often applied to analysis of dialogic discourse between one child and one adult and it was usually measured as the density of 'multi-clausal utterances' in the total number of 'conversational turns'.

Other studies quantified the number of clause utterances in the total number of utterances (Pena, et al., 2006). Such quantification (i.e. the number of clauses in *all* utterances) would require some degree of control over the type of task that has been set to stimulate the use of talk (Shiel, 2000, p. 247), for example, restraining the language sample produced to narrative only. In the Pena et al.'s (2006) study, for instance, children generated a story during both pre- and post-intervention assessment.

The diversity of response types in a classroom is great and many lessons simply do not invite syntactically complex structures, while some do not invite many sentences at all (such as aforementioned word level tasks, i.e. phonics, phonological awareness or word recognition-tasks). Due to this diversity of lesson content and the topic restrictions to which children's language is often subjected in the classroom, clause density in the *total* number of utterances produced within the classroom context may not be an adequate measure of a child's linguistic abilities. Thus, in the present study, loquacity was computed as the number of 'multi-clausal responses' in the total number of all 'clause responses' and *not* in the total number of *all* responses. Such definition excluded single word and phrase utterances from analysis for this dimension.

3.6.4 Syntactic complexity

- *Syntactic complexity* was defined as the proportion of 'complex sentences' (multi-clausal utterances with clauses in either subordination or coordination relationship) in the total number of complete sentences produced.

Complex sentences are defined in the broad sense as multi-clausal utterances with clauses in either coordination or subordination relationships (Lund, 1993). In the coordination relationship, clauses are equal (e.g., *My ma got a new telly and I watched Chucky*) and in the subordination relationship one clause is dependent (e.g., *I got make up for Christmas cause I am good*). Clauses conjoined in a coordination relationship are sometimes called compound sentences and are distinguished from complex sentences which are restricted then only to sentences with a dependent clause. Among complex sentences created by pre-school children, 'when' and 'because' conjunctions are prevalent.

In the present study, the broader definition of complex sentences was adopted and a *complex sentence* was defined as any multi-clausal utterance with clauses conjoined by any subordination or coordination conjunction, except conjunctions 'and' and 'then'.

The use of 'and' and 'then' is characteristic in young children's narrative language (e.g., *One seal went over to the wall right and Jonathan said hello hello and the seal said ppp*). The studied children made a heavy use of these conjunctions and thus inclusion of 'and' and 'then' in the definition of complex sentences could fail to distinguish children who created more complex sentences with 'if' or 'because'. This language feature revealed itself prominent at the administration of the Formulated Sentences subtest of CELF-3UK. During administration of this subtest, children were required to formulate sentences with given words about pictures in the stimulus book. A majority of participants, given a word 'and', formulated sentences with this word at the beginning (e.g., *And I am cleaning the garden, And the cat and the dog are playing, And because I like that*).

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In the present study, constructions with linguistic verbs (e.g., *And she said that's not good*) and mental verbs (e.g., *I know what he is going to do, I think she likes him*) were also coded as multi-clausal as they embed one clause in another (Lund, 1993). Constructions with mental and linguistic verbs as well as constructions with conjunctions were coded as complex sentences. Both are features of literate language (characterised also by the use of elaborated verb phrases and adverbs).

All syntactically complex sentences that were complete were computed in this dimension, regardless of whether they were grammatically correct or not (e.g., due to the absence of obligatory morphemes).

3.6.5 Grammatical Correctness

- *Grammatical correctness* was defined as the proportion of 'syntactically and morphologically correct utterances' in all *verbal* utterances produced.

In the present study, ungrammatically built utterances included both utterances that lacked obligatory linguistic units and utterances that had an erroneous structure (e.g., word order). The errors made by children in the present study varied but they most often belonged to the following categories:

- Lack of morpheme in obligatory context (e.g. *Whose bed is this? – Dad; I play out yesterday*). Morphemes most often omitted were inflections. An error was coded only if the morpheme was obligatory in the context. If the child initiated *Look Goldilocks in bed* the lack of copula 'is' was not coded as an error as there was no obligation placed on a child to create a full sentence. An absence

of some auxiliaries may occur in connected speech and thus it was not coded as an error (see below for elaboration).

- Incorrect phrase/sentence structure (e.g., incorrect connector or reversed word order, as in the following examples *Me went downstairs and that's a letter, Cause if fighting it does would hurt, He is thinking to make a friend in monkey, That's Casey is sitting, I forgot where it's called*).

It is now widely accepted that while analysing a language sample of linguistically/culturally diverse populations, it is imperative to distinguish between impairment and a language difference (Seymour et al., 1998). Dialectal variations were considered while analysing for the dimension of *grammatical correctness*. The following grammatical features were considered acceptable (chosen from Lund, 1993, p. 171-173) and were *not* coded as 'incorrect':

- Subject/verb disagreement: *Where is the trees*

- Absence of demonstrative pronouns, 'them' for 'those' or 'these': *I can see them things*

- Genitive instead of nominative case: *Me and my ma are going to the zoo on Sunday*

- 'It' instead of 'there': *It's a hedgehog there*

- Absence of contractible auxiliaries: *They playing that* (absence of 'are'), *I be doing that at home* (absence of 'will').[64]

In differentiating between a language difference and impairment of non-standard English speakers, it is advisable to focus on *non-contrasted* features

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[64] A contractible linguistic unit needs another unit to create a meaning, e.g. 'is' in 'He is working' (it creates the full meaning with 'working'). In contrast, an uncontractible linguistic unit provides a full meaning by itself, e.g. 'is' in 'He is there'.

(shared features) between standard English and the dialect spoken by the studied population/community (Seymour et al., 1998). Deletion of contractible linguistic units is a contrasted feature (i.e. non shared feature). In some non-standard dialects of English, linguistic units that are contractible in standard English are usually deleted (as in African American English) (Washington & Craig, 1994). Thus, omission of contractible auxiliaries was *not* coded as 'syntactically/morphologically incorrect', as in the following examples:

Why wouldn't lots of chocolate cake be good for you?

You get sick

How do you know I am alive?

You moving you putting stuff in the box

I seen that before

'Syntactically/morphologically incorrect' utterances that were self-repaired were not scored as 'incorrect', e.g. *He rob he robbed that stuff.* In this perspective, the presence of an additional unnecessary subordinator or coordinator, although considered erroneous in some studies (e.g., Gummersall & Strong, 1999), was not classified as an error of a sentence structure if the remaining sentence was correctly built, e.g. *Because he checked everywhere for it and it wasn't there.* Some studied children used many such maze behaviours (e.g., repetitions, hesitations and false starts) during utterance formulation, particularly 'because' (e.g., *Because that's why they buzz, Because they because they always don't like when they get angry, He said because he thought he was getting the cat*). Sentences with subordinate

conjunctions as interjections (e.g., the quoted 'because') that did not introduce a relationship between two clauses with one clause being dependent, were not coded as syntactically complex sentences. Furthermore, teacher's feedback was not a criterion when considering which utterances were identified as 'incorrect', e.g.:

Child: Me and my ma (...)

Teacher: My mammy and I

Teacher: What colour is that?

Child: Red

Teacher: It's not red/What colour is that, anybody?

Child: Look there is a turtle.

Teacher: It's a tortoise/Turtles are different animals.

3.6.6 Pragmatic Appropriateness

- *Pragmatic appropriateness* was defined as the proportion of 'pragmatically appropriate and conversationally adequate responses' in all *verbal and nonverbal* responses produced.

Pragmatically inappropriate/inadequate responses in the present study varied but they belonged most often to the following categories:

- Overly literal response that does not appreciate the speaker's intention (Bishop et al., 2000, p. 198)

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Katie do you want to speak/do you want to say something?

Yeah

- ■ 'Don't know' response to a solicitation to which a child should be able to provide a response (Adams et al., 2006; Bishop et al., 2000)

What did you do yesterday after school?

Don't know

(*What does being jealous mean? – I don't know –* was *not* coded as inappropriate/inadequate pragmatically response)

- ■ Inadequate responses (wide range; these responses constituted a significant majority of responses in this category)

Where does your mammy work/in a shop/in a hospital?

In a worker

What shape are they?

Windows

What season do we have now?

Windy

What's your favorite animal?

Red

Clausal utterances that were abandoned by the child were *not* coded (e.g., *He went/*) and other non-clausal incomplete responses that were conversationally inadequate because of their linguistic limitation were coded 'pragmatically inappropriate/inadequate' (e.g., *What do you think might happen in that story? – Get lost. Come on what would happen? – Go bed*). Utterances such as *I know that yoke* or *I am gonna get that rope and do like that* were *not* coded as erroneous on the basis of lexical selection but utterances that were markedly semantically unspecific *(e.g., Why do you think so Katie? - Cause it's thing they something that about that this)* were coded as 'pragmatically inappropriate/inadequate'.

'Semantically incorrect' responses were not distinguished as a separate category as such a distinction would be more suitable for studying the language of EAL children (Hahne & Friederici, 2001). This category would be used in situations when speakers use a word or words in semantic context that would not be generally acceptable by native speakers. The present study does not separate 'semantically incorrect' responses (although the studied sample consisted of a few EAL children) and responses that could be classified as such were coded as either 'pragmatically inappropriate/inadequate' if the error related to the communication level (i.e. a failure in comprehension or some linguistic deficiency), as in *What season do we have now? – Windy,* or as 'syntactically/morphologically incorrect' if the error occurred on the level of utterance, as in *Why couldn't he sleep? - Cause the moon is too light (*meaning: *bright).*

3.7 Measurement of Changes in the Teachers' Behaviour and the Lessons' Content

A classroom SFA evaluation study conducted by Palmer (1998) (whose methodology included classroom observations) measured a 'teacher's behaviour' and a 'teacher's position' across all observations in order to control for possible changes that could have influenced changes in pupils' behaviour. Palmer (1998) did not find significant changes in the 'teacher's behaviour' and the 'teacher's position' between the baseline and intervention phases.[65] Changes in a 'teacher's position' were not observed in the present study as the class setting and the pattern of interaction were similar across all sessions, i.e. all lessons had whole class structure and all lessons were oral language lessons[66], with only elements of direct literacy instruction (e.g., phonics, phonological awareness tasks, reading) and elements of maths.

The lesson content was considered to have a strong effect on language scores in the classroom and thus it was monitored across all observations. A 'teacher's behaviour' was specified as 'teacher's stimulus' and was systematically observed throughout the whole study. 'Teacher's stimulus' was measured as the number of questions posed to the whole class and the number of obligations posed to the observed children. The content of lessons was measured quantitatively as the percentage of word level responses[67] in all responses produced by the observed

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[65] 'Teachers' behaviours in Palmer's study were: no response, teaching, other talk, approval and disapproval.

[66] Religion and environmental lessons introduced in the form of classroom discussions or stories were considered oral language lessons.

[67] 'Word level utterances/responses' were defined as 'single word utterances/responses that operated on the phonological, syntactic or semantic level of words or that were numbers or read out words (e.g., *Give me an 'ing' word? What other words start with 'm'? Who can read that word? What number does it say?*).

children and descriptively (e.g., story time, picture description, topic discussion). The differences in the wealth and characteristics of language samples obtained in each study phase, as well as the teachers' stimuli across study phases were quantified for each study phase, for all participating children, all participating classes and for the whole sample.

The wealth and characteristics of language samples (partly attributed to the teacher's stimulus) were measured in the following aspects:

- The number of all utterances

- The number of clausal utterances[68]

- The proportion of word level utterances in all utterances

The teachers' stimuli were measured in the following aspects:

- The number of teachers' questions directed to the whole class

- The number of teachers' obligations directed towards observed children

- The relationship of the number of teachers' obligations directed towards observed children to the number of teachers' questions directed to the whole class (presented as a score).

3.8 Ethical Considerations

As Thyssen (1992) notes, ethics regulates problems arising in subsystems by regulating interactions between different cultures co-existing within a subsystem, being thus neither an individual matter nor a collective decision. It was ensured at *all* stages of this research that the acceptance for continuing the study was obtained from each subgroup involved in the study. As the author of this thesis holds a

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[68] Clause consists of a subject and a predicate and any number of modifiers (e.g. adjectives).

professional membership of the Irish Association of Speech and Language Therapists, this study was carried out according to the ethical guidelines of St. Patrick's College (2006) *as well as* the ethical guidelines of the speech/language therapy profession (American Speech-Language-Hearing Association, 2003; Irish Association of Speech and Language Therapists, 2006a; 2008). These guidelines have been developed to protect participants in human research.

3.8.1 Informed Consent

After a consultation with the researcher, written informed parental consent forms were distributed by each school and were signed by the parents. The informed consent forms stated clearly that participation was voluntary, that participants had a right to withdraw at any time, and that the author of the study intends to publish its results (see appendix R). All children received parental consent to be video-recorded and tested on a one-to-one basis by the researcher.

3.8.2 Access to Teachers

Teachers from all but one school chosen for participation in the research by their school principals consented orally to being videotaped. The teachers were given notice in advance of each recording. During the study, a teacher in one school (class H) felt that a video camera was intrusive to his teaching. After a meeting a consensus was reached, and the amount of recording in this class was decreased by 30 percent. A teacher of first class in another school did not agree to be videotaped frequently at the end of a school year and thus the time gaps between data points in this class were wider (class G).

3.8.3 Respect for Children's Feelings

The language assessments were conducted in a one-to-one setting where possible, which is in accordance with speech/language therapy guidelines (Wiig et al., 2005). The researcher obtained Garda Clearance prior to the commencement of the study for the purpose of these assessments. Most children did not evidence any difficulties about leaving their classrooms for testing with the researcher. If a child wished, she/he could request a friend to be present during the assessment. Children who felt anxious about leaving the class with the researcher (at the pre-intervention assessment) were tested either in the presence of a Special Needs Assistant (SNA) or a friend of their choice. This related to 2 children only. The presence of the same SNA/friend was requested at the post-intervention assessment. The SNA/friend was not engaged in the actual test administration and was asked not to provide feedback to the child. The scheduled test was not administered to one child (child F-C3) who was anxious about leaving the class for testing.

3.8.4 Confidentiality and Anonymity

Any information obtained in connection with this study that could identify the participants remained confidential and was omitted from the results. All information is presented in this study in such a way that no study participant can be identified. Children's names are coded in the report. Teachers are identified by codes of their classes, e.g., teacher of class A.

3.8.5 Data Storage

All video and tape recordings, standardised tests' results, classroom transcripts and all processed data were securely stored for the duration of the study

and destroyed after 2 years. The researcher was the only person who had access to the raw and processed data during the study.

3.8.6 Coding

Children's names were coded using the code of their class (alphabet letter) and a number (e.g., A1, C4, K5). This is contrary to the usual procedure found in SLT studies where children's names are coded using their initials. That modification was made in order for a reader to identify clearly what class the child was from. Both numbers and letters were assigned randomly and follow no logic. The child's gender was indicated by either 'M ('male') or F ('female')' at the beginning of the child's code (e.g., F-A1, F-C4, M-K5). Thus, F-M2 means 'a female from a class coded as M' and M-G3 means 'a male from a class coded as G'.

Graphs that show a range of 0.0-1.0 may be interpreted as percentages, that is a score of 1.0 is a maximum score and may be interpreted as 100% and a score of 0.0 is a minimum score and may be interpreted as 0% (e.g., a score of 0.50 in responsiveness means that a child responded to 50% of the teacher's obligations and a score of 0.79 in syntactic complexity means that 79% of the sentences produced by the child were complex sentences). Graphs that show the participation dimension have a range 0-300; there is no maximum score for this dimension, so a score of 300 was chosen conventionally as a maximum score and it may be interpreted that the number of the child's responses is three times higher than the number of the teacher's questions (e.g., when the teacher posed 4 questions to the whole class and the child volunteered to respond 12 times). All quotes in italics are excerpts from classroom transcripts.

3.9 Study Limitations

3.9.1 Limited Context

One of the unavoidable weaknesses of this study is the fact that the non-school systems were not known to the researcher. There are a number of factors that affect children's behaviour in the classroom, hunger and lack of sleep being just a few that have been identified by previous researchers in DEIS schools (Downes & Maunsell, 2007). Other factors potentially unknown to the researcher include indirect interpersonal influences, such as the expectations of a teacher towards a child, as well as the quality of the child's primary dyad with his/her caregiver and his/her involvement with other adults in non-school settings. It was beyond the scope of this thesis to sufficiently focus on the interpersonal relationships and the interactions between the observed teachers and each study participant. The linguistic behaviour of the participants is explained in this thesis largely through the analysis of the classroom microsystem. Thus while SFA is conceptualized within a larger systemic context, the analysis of meso- exo- and macro- systems, as well as other crucial microsystems such as the family, was not conducted.

The teachers participating in this study were not formally interviewed in relation to their beliefs and attitudes to the intervention and to the language teaching and learning. For instance, the teachers who did not believe in the benefits of the intervention might not have worn the SFA equipment as frequently as the researcher would have hoped for. Foster-Fishman et al. (2007) cite Armenakis et al. (1993) who state 'While a positive attitude towards a system change pursuit does

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not assure its adoption, it is unlikely that system transformations will occur in the absence of positive appraisals of the change' (p. 207).

3.9.2 Language Sample

The studied children's language samples recorded in the classrooms could have differed from the language those children used at home and in other 'more naturalistic' social settings, and this was perhaps true particularly in the whole class setting, which was the lesson format most often recorded in this study. Language samples collected in the classroom are likely to be less representative of the children's true linguistic potential than open narratives. The whole class format in which language samples were recorded enabled mostly children's interactions with the teacher, and did not particularly encourage peer-to-peer interactions that form a crucial communication mode in early childhood settings.

Language samples were not consistent across all study phases for all participants in the study. This observation is relevant especially to syntactic complexity, loquacity and grammatical correctness dimensions. One might expect that the occurrence of certain linguistic features may be more likely in a richer language sample than in a linguistically poorer language sample. In other words, the more utterances the child produces, the greater is the likelihood that some of them are multi-clausal, syntactically complex, or grammatically incorrect. The presence of richer language samples in the intervention phase was a somewhat unavoidable phenomenon. This phenomenon was both an intervening variable and an outcome of the intervention, i.e. a likely result of increased verbal participation in the classroom. Additionally, poorer language samples at baseline might have

affected the judgment on grammatical correctness. Four classes out of 14 studied showed no clear pattern on this dimension.

3.9.3 Maturation

Maturation effect must be acknowledged as data collection took place over one academic year in most classrooms. This applies particularly to junior infants. It is recognised that children starting school may adjust to the classroom context and formal school rules for even over a few months (Evans, 1996). It must be stressed, however, that maturation effect may be stronger in relation to three out of six analysed language dimensions, namely loquacity, syntactic complexity and grammatical correctness. It may be less relevant to participation, responsiveness and pragmatic appropriateness dimensions. It is important to note that no language gains observed in this study can be simply attributable to maturation as varying intervention outcomes were observed for different pupils and classes. One cannot assume that maturation was relevant to those classes that made gains and not relevant to those where negative outcomes were noted.

3.9.4 Tool of Recording

It is likely that the presence of the researcher videotaping the lessons modified the behaviour of both the pupils and the teacher. The effect of the observer in the classroom is known in participant research as the Hawthorne effect (Landsberger, 1958). It might have been that the teachers presented lessons that were more language-rich while being observed and/or that the quality of the observed lessons differed from the quality of unobserved lessons. The camera might have been threatening to some study participants and its presence could have

led to the staging of some of the lessons. Children in some classes were additionally pre-sensitised prior to the recordings by being told by their teachers that, for instance, the video would be going to the principal if they misbehaved, or that they were chosen to show how well they behaved. This was the case especially during initial recordings before both the teachers and the children became gradually accustomed to being videotaped. This initial camera intrusiveness could have resulted in teachers presenting more structured lessons and thus children making fewer elaborations. These influences were reported also by other studies that used video cameras (Girolametto et al., 2000).

The whole class format chosen for the observations might have limited both the teaching methodologies and the productivity of the language samples. However, such a format was necessary in order to collect a wider number of naturalistic language samples of good acoustic quality in a relatively short time period. It must be emphasised, however, that, firstly, class size in schools designated as disadvantaged is lower than in other schools, secondly, that the whole class format was requested solely for the collection of language data, and, thirdly, that story time in a circle setting is frequently introduced in a whole class format in the Irish infant classrooms. This was a lesson mode most commonly introduced by the observed teachers.

Most children had been tested with the use of standardised tests before they were observed in the classroom. This might have affected the extent to which the obtained data were natural as some children could have known that they were being observed. On a few occasions, some children were asked to change their seats. This request was directed due to the limitations of the recording equipment (the camera did not 'cover' all children in some of the largest classrooms).

3.9.5 Potential Linguistic and Format Biases of Standardised Tests

The reliability of standardised tests' results is lower for very young children due to their short attention spans, varying levels of responsiveness (transient responsiveness), distractibility and low verbal skills (Haywood & Tzuriel, 1992). A significant percentage of children tested were below five years of age at the beginning of the study. Children seemed especially prone to distraction during Recalling Sentences subtest, in which they were required to listen to the story and recall the exact sentences from the story. It is interesting to note that boys performed less well on this subtest than girls (38% of boys and 56% of girls scored within the normative range on this subtest). Perhaps this reflects the influence of attention on test results. Attention difficulties are diagnosed four times (ratio 4:1) more often among the male population (Sandberg, 2002; Lahey et al., 1994; Timimi et al., 2004).

It was observed that the elements of two subtests of expressive language component of CELF could have been linguistically biased against the studied children. These relate to Word Structure subtest that targets specific language features of the standard version of English (e.g. *has* in *She has done it*) and Recalling Sentences subtest that assesses productive syntax through sentence imitation-tasks. The elaboration on the linguistic biases of these two subtests is presented in chapter six, together with a recommendation for a dynamic assessment of these two areas, conducted by speech and language therapists who work with children in areas designated as disadvantaged in Ireland.

3.9.6 Possible Judgement Bias of the Researcher

There were a number of aspects measured qualitatively in this study, including the size of the classroom and the quality of language teaching. Some qualitative indices had some quantitative categories. For instance, the frequency of the teacher wearing the microphone was measured by the number of times the teacher wore the microphone on days the researcher visited the relevant schools. The size of the class was measured by recording of the number of students present in the classes during each recording taken and averaging of these data for each class.

There were, however, no formal measurements taken to determine the dimensions of the classroom. Classrooms were assigned to either 'large' or 'not large' category. This was agreed with another observer. While consensus was reached between the two observers in relevance to all classrooms, it is recognised that this consensus was not based on any quantitative criteria (i.e. the measurements of the rooms were not taken). The quality of language teaching was characterised according to a number of criteria that are well researched in the speech and language literature as being facilitative for children's language development. It is recognised, however, that no inter-researcher agreement was conducted in relation to such judgements. No inter-rater reliability measures were taken with respect to classroom interactions.

3.9.7 Other Limitations

Children who were perceived by their teachers to have learning difficulties received additional support in schools. Some children participating in the present study attended resource hours or learning support hours, while some were assigned

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to other interventions, such as Reading Recovery programmes.[69] Additional in-school and out-of-school supports received by the study participants are noted in case studies of individual study participants, where relevant. The teachers were not aware of any child participating in the study attending speech and language therapy during the study.

Participating children did not receive medical screenings and their history was not known in relation to potential oral-motor, neurological or hearing impairments, including potential periodic (fluctuating) hearing difficulties. It could have been that hearing difficulties affected the performance of some study participants on some dimensions during some stages of the study. This was identified by Palmer (1998), who evaluated the effect of classroom sound field amplification on on-task behaviour through classroom observations, to have a confounding effect on scores in some phases of the study.[70] Furthermore, the acoustic qualities of individual classrooms were not formally measured in terms of reverberation time and noise levels.

Children's voices did not inform the conclusion on the efficacy of SFA in the studied classrooms.[71] Most participants were asked informally about their experiences of SFA in their classrooms at the post-intervention standardised assessment (*Do you like or not like when your teacher wears the microphone? Why (not)?*). One of the most interesting aspects of the SFA use referred to by two

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[69] In one school (with classes M and G) there was a Reading Recovery programme (one-to-one literacy instruction), 'hour power' which was intensive language/literacy instruction delivered to each class for one hour a day, as well as drama lessons and play therapy provided by external persons visiting school on a weekly basis.

[70] Although participants of the present study were not screened for hearing, it was known that three study participants (children M-G4, M-M4, M-K3) underwent grommet microsurgery (grommets are small tubes inserted in the middle ear in order to clear the hearing canal) and that one child (child F-N5) had inconclusive hearing test results (i.e. she passed the hearing test on one occasion and failed it on another).

[71] While many previous SFA researchers reported teachers' opinions on SFA (Flexer, 2002; Massie & Dillon, 2006b; McSporran et al., 1997; Sarff et al., 1981), only Massie & Dillon (2006b) recorded children's voices.

children from class E was the quality of the teacher's voice (*she speaks nice now; she does not shout anymore; she used to get annoyed*). These reports, presumably referring to the fact that SFA *equalizes* the teacher's voice in addition to *amplifying* it, suggest that SFA may positively influence the classroom climate in some classrooms, a suggestion that is in agreement with the view of SFA as an inherent part of the systemic structure of the classroom. Future SFA evaluations could explore this potentially hugely interesting aspect of this intervention.

Finally, it must be emphasised that the conceptual underpinnings of this thesis are based on the most common assumptions in the systems theory sciences that relate to the general complexity of systems and the multiplicity of interrelated relations between the system elements. It is recognised that there are more complex perspectives within the systems theory field, the discussion of which was, however, beyond the scope of his study.

CHAPTER FOUR

4.1 Case Studies

This chapter includes 38 case studies which present findings on 9 language dimensions, namely participation, responsiveness, pragmatic appropriateness, loquacity, syntactic complexity, grammatical correctness, norm-referenced receptive language, norm-referenced expressive language and norm-referenced receptive vocabulary for each study participant from junior infants and senior infants, where relevant. Not all students were tested for all dimensions (see chapter three); graphs and findings are presented where tests and analyses were carried out. The dimensions of participation, responsiveness, pragmatic appropriateness and receptive language are presented in graphs. For individual scores on loquacity, syntactic complexity and grammatical correctness see appendices M-O. For individual scores on norm-referenced receptive language, norm-referenced expressive language and norm-referenced receptive vocabulary, see tables 16-18 in chapter five. Other details including the number of utterances and clause utterances produced by each study participant in each study phase as well as the number of teacher's questions to the whole class and his/her obligations directed to individual study participants are presented in appendices C-G.

Graphs presenting findings on participation, responsiveness, pragmatic appropriateness and receptive language of the study participants from first classes (class K, F, G and O), class N (junior infants) and class M (senior infants) are

presented in appendix S. The 8 classes analysed at a case study level and included in this chapter were selected on the basis of a criterion sampling by age of the class and the teacher's use of the provided microphones (see chapter three for elaboration).

Differences between post-intervention (B) and pre-intervention (A) assessment results were indicated by either + for 'an increase' or − for 'a decrease' and either CI-o for 'overlapping confidence intervals' or CI-no for 'non-overlapping confidence intervals'; e.g., if a child's standardised score was 87 pre-intervention and 92 post-intervention this would be signified as +5 CI-no, meaning 'an increase by 5 standardised scores, non-overlapping confidence intervals', if a child's score was 90 pre-intervention and 88 post-intervention, this would be signified by -2 CI-o, meaning 'a decrease by 2 standardised points, overlapping confidence intervals'.'Gaps' on the graphs presenting participation indicate that a child was absent for this particular recording.

School 1: DEIS Band 1 status

Class B, junior infants

Table B.1. Profile: Class B

Geographical area	Ballyfermot
Age of the class	Junior infants
Start of the intervention	SFA installed at the start of school year (Nov)
Group/Class size (averaged from all recordings)	22 children (>15; 'large')
Classroom size (inter-observer agreement)	Large
Teacher's use of SFA	Teacher wore the microphone every day the researcher arrived

Narrative for the class

The teacher of class B consistently displayed elements of good quality of language teaching. She was observed to enable expository language on a number of occasions, posed many open-ended questions and frequently used a variety of language stimulation techniques. She was observed to pose many cognitively challenging questions (i.e. questions of high level of abstraction). Power relations in the class were shifted towards the children with a very positive encouraging classroom climate observed consistently throughout all recordings. All observed lessons were recorded in the context of a story time, with discussion both before and after the story.

Class summary

A majority of children in this class showed gains in a majority of language dimensions, both classroom derived dimensions and norm-referenced dimensions. In the absence of many intervening variables (consistency of lesson content and format), it can be concluded that these gains could have been attributed to the intervention.

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Table B1.1. Profile: <u>Child B1</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	4 years 3 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study[72]	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration[73]	12 months
Teacher's use of microphone	Teacher wore the microphone every day the researcher arrived

Figure B3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[74]
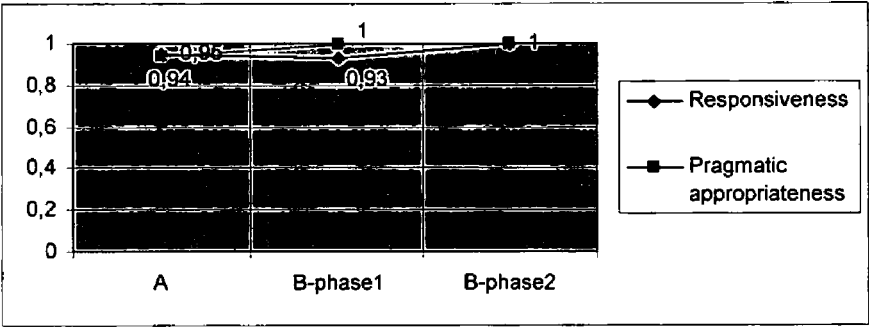
Findings:

Clear gains in *pragmatic appropriateness*

Gains in the 2nd intervention phase in *responsiveness*

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[72] See Glossary for the definition of 'auxiliary services'

[73] Time between pre-intervention and post-intervention norm-referenced assessment

[74] (A): 4 recordings, (B1): 4 recordings, (B2): 4 recordings

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Figure B4.1. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
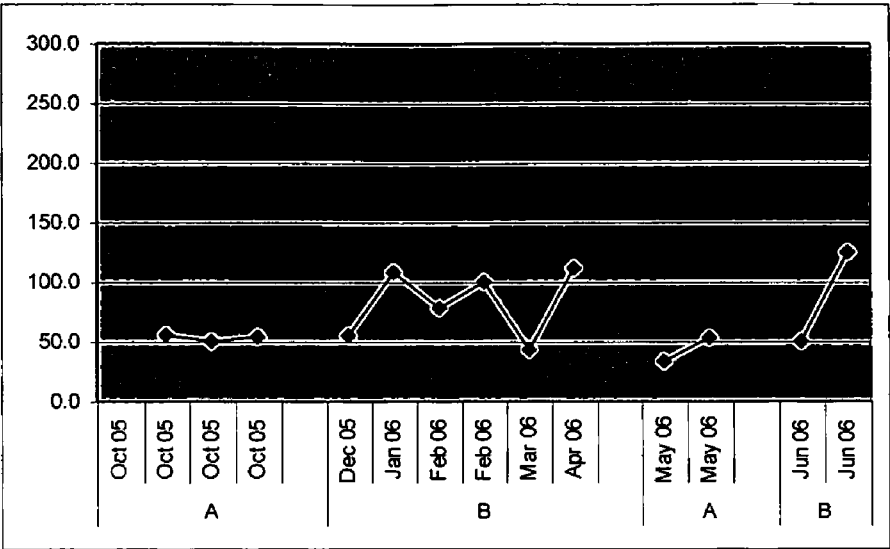
Findings:

Clear gains in *participation* (follows ABAB design)

Participation increased during some lessons after the introduction of intervention, it decreased with the withdrawal of intervention and increased (though not immediately) with the return of intervention.

Clear gains in *loquacity*[75]

Clear gains in *syntactic complexity*

Probable gains in norm-referenced receptive vocabulary (+9 CI-no)

No gains in norm-referenced expressive language (-6 CI-no)

No change in grammatical correctness

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[75] Individual loquacity and syntactic complexity scores are shown in appendices M-N. Individual results of norm-referenced language assessment are shown in tables 16-18 in the next chapter.

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Intervening variables:

- In comparison to the baseline data, a greater number of his utterances in the intervention phases were volunteered utterances.

- He was faced with a greater number of teacher obligations in the baseline than in either of the intervention phases.

- Lesson content: Higher cognitive demands during 5th intervention recording

His participation level was lower during the 5th recording in the intervention phase (March 06). During that lesson, the teacher introduced a story in which characters from other known stories appeared. Perhaps that created more processing demands (as children had to additionally access the knowledge about the known stories). Participation level during that lesson was lower also for other children who were observed in this class.

- Time and weather

Participation dropped in May 06. May 06 was a very hot period. Withdrawal of intervention phase happened to be in May.

Conclusion:

Although he did not increase his responsiveness level immediately after the introduction of the intervention, all his responses were pragmatically appropriate and adequate. This might suggest that he could hear the teacher better. The length and complexity of his utterances also increased in the intervention phases. This increase could not be attributable to the richer language samples obtained in the intervention phases, as gains were noted *immediately* on most language dimensions (i.e. they did not occur only in the last intervention phase) and they did not seem to be connected to the number of utterances available for analysis in the 1st and 2nd intervention phases (i.e. the scores did not decrease in the 2nd intervention phase although the number of utterances in the language sample for this phase decreased, as shown in appendix C). Gains were also observable in the norm-referenced receptive vocabulary score and a clear ABAB design was noted in participation. It can be concluded that the intervention clearly benefited the language performance of this child.

Table B1.2. Profile: Child B2

Gender	Male
Age at the start of intervention	4 years 6 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every day the researcher arrived

Figure B3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[76]
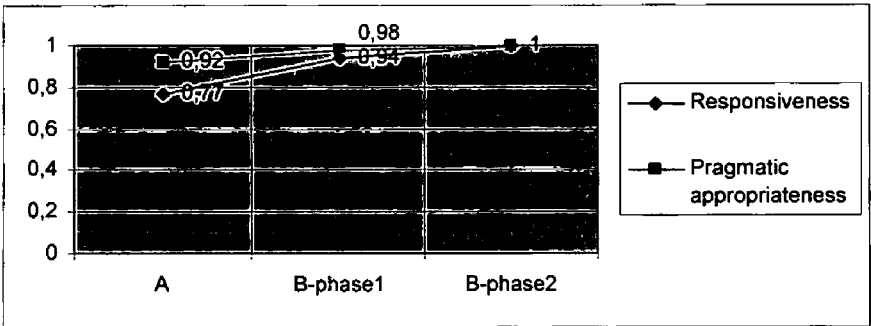
Findings:

Clear gains in *responsiveness*

Clear gains in *pragmatic appropriateness*

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[76] (A): 4 recordings, (B1): 4 recordings, (B2): 4 recordings

Figure B4.2. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
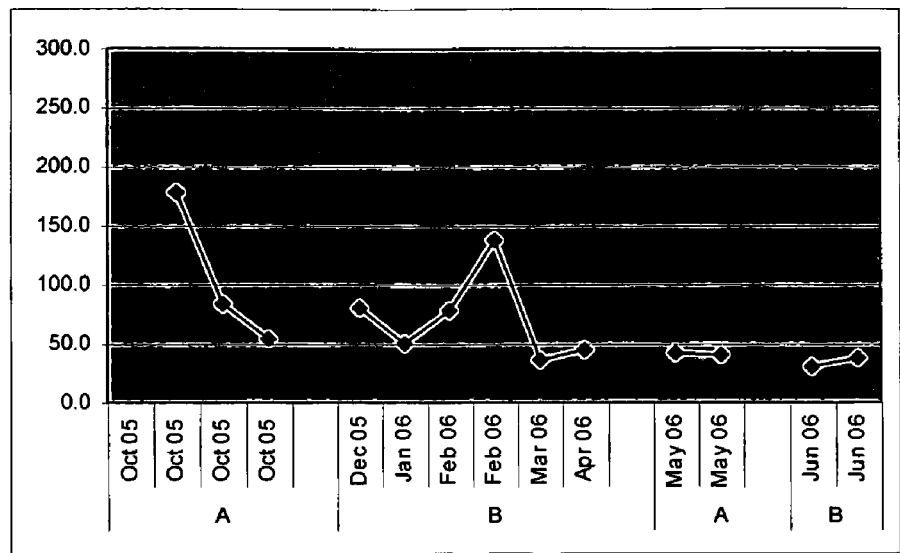
Findings:

No gains in *participation*/Not clear pattern (decrease at the end of the study)

Clear gains in norm-referenced expressive language (+4 CI-no)

Clear incremental gains in *loquacity*

Clear incremental gains in *syntactic complexity*

Probable gains in norm-referenced receptive vocabulary (+3 CI-o)

No gains in *grammatical correctness*

Intervening variables:

- The baseline profile indicated strong language skills.

He produced multi-clausal utterances (20 per cent) and some syntactically complex utterances (6 per cent) before SFA was installed. His language abilities were well within the norms for his age as measured with CELF-P (see table 18). His lower *responsiveness* during the baseline phase could have been due to lowered attention level as his baseline language abilities were good. His *responsiveness* increased significantly and immediately under the amplification.

- Lesson content: Higher cognitive demands during 5th intervention recording

See 'Intervening variables' in a case study of child B1 from this class for elaboration.

- Lesson content: Familiar story during the 2nd baseline recording

His *participation* level was very high during the 2nd baseline recording (first lesson shown on a graph). He was familiar with a story introduced during that lesson. He was recorded saying *I know I know Goldilocks* at the beginning of the lesson.

- Lesson content: Low level of abstraction during the 4th intervention recording

His participation level was high also during the 4th recording in the intervention phase (the second February recording). Children named different animals during that lesson. The animals were presented on pictures. All observed children from this class participated well during that lesson.

- Time and weather

Participation dropped in May 06. May 06 was a very hot period. Withdrawal of intervention phase happened to be in May.

Conclusion:

Gains were noted on most language dimensions. There was a relative consistency across study phases in terms of the teacher's stimulus (number of questions and obligations), the richness and characteristics of this child's language sample, the lesson content and format. It can be thus concluded that the intervention benefited this child's language performance, both observed in the classroom and measured in a norm-referenced comparison.

Table B1.3. Profile: <u>Child B3</u>

Gender	Female
Age at the start of intervention	4 years 6 months
Language skills pre-intervention	Mild expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months[77]
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone every day the researcher arrived

Figure B3.3. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[78]
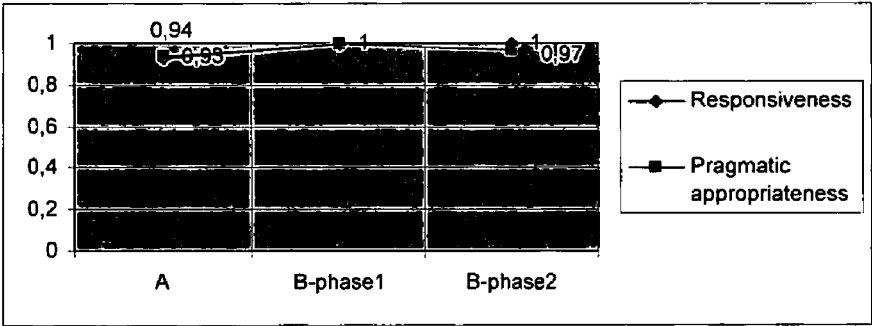
Findings:

Clear gains in *responsiveness*

Probable gains in *pragmatic appropriateness*[79]

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[77] This child was in an amplified class for one month in the last term of junior infant class. She was exposed to the intervention again after the summertime, when she repeated junior infants.

[78] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings

[79] Slight decrease in score occurred in the 2nd intervention phase.

Figure B4.3. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
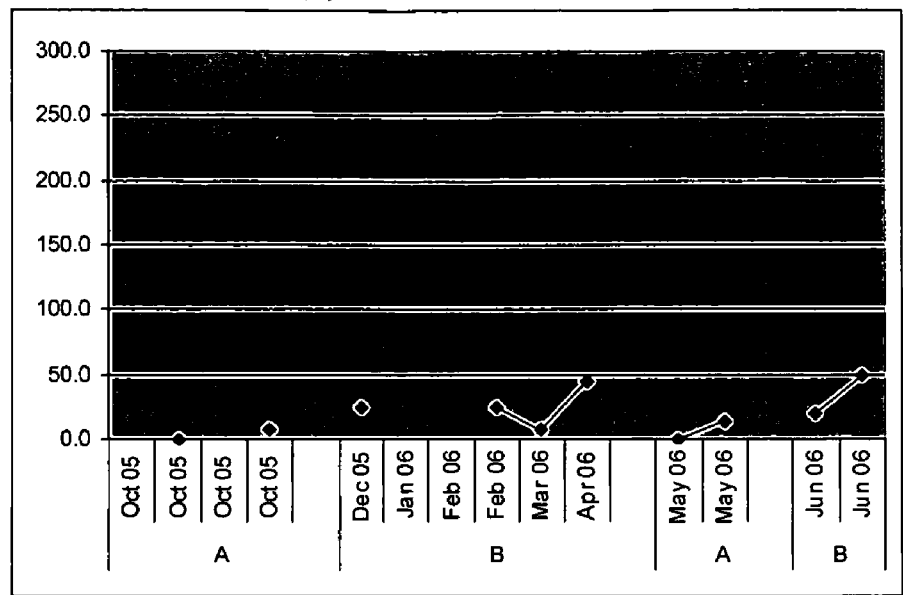
Findings:

Clear gains in *participation* (follows ABAB design)

Her *participation* increased with the introduction of intervention (except the 5th intervention recording), it then decreased with the withdrawal of intervention and exhibited increasing pattern again with the return of intervention.

Probable gains in norm-referenced receptive vocabulary (+8, CI-o)

No gains in norm-referenced expressive language (-6 CI-no)

Gains in the 2nd intervention phase in *loquacity*

Gains in the 2nd intervention phase in *syntactic complexity*

No gains in *grammatical correctness*

Intervening variables:

- Lesson content: She produced some pragmatically inappropriate and inadequate responses in the 2nd intervention phase.

The teacher posed more cognitively challenging questions towards the end of the school year (e.g., *How are you different from other people; What is different about the two of them*). She, and other children with weaker language abilities from this class, had difficulties answering some of them (e.g., *What is different about the two of them? – Cause two baby*). Pragmatic appropriateness scores decreased in the 2nd intervention phase also for other study participants from this class: child B4, child B5 and child B6. Only child B1 and child B2, whose baseline language abilities were stronger, produced no pragmatically inadequate and inappropriate responses in the 2nd intervention score.

- Lesson content: Higher cognitive demands during the 5th intervention recording

See 'Intervening variables' in a case study of child B1 from this class for elaboration.

- In comparison to the baseline and the 1st intervention phase, she produced more utterances, including more clausal utterances, in the 2nd intervention phase.

Conclusion:

Gains were noted on most language dimensions, with the exception of a norm-referenced expressive language total score. While gains in *loquacity* and *syntactic complexity* could have been partly the result of a richer language sample and maturation effect (they occurred in the 2nd intervention phase only), gains in *responsiveness, pragmatic appropriateness* and *participation* were likely attributable to the intervention.

School 1, class B, junior infants

Table B1.4. Profile: <u>Child B4</u>

Gender	Female
Age at the start of intervention	3 years 11 months
Language skills pre-intervention	Mild expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every day the researcher arrived

Figure B3.4. **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[80]
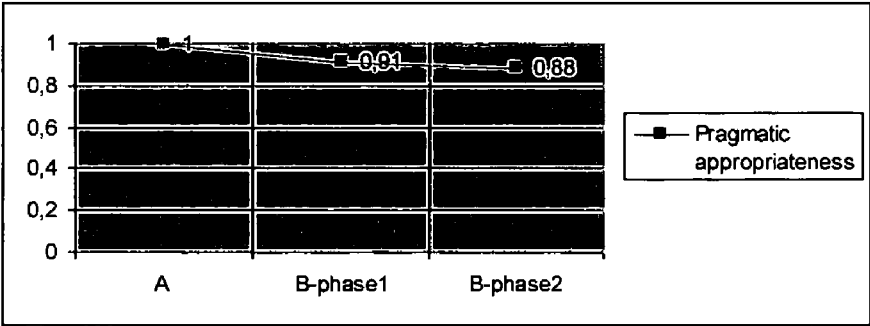
Findings:

Decrease in *pragmatic appropriateness*

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[80] (A): 4 recordings, (B1): 4 recordings, (B2): 4 recordings.

Figure B4.4. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
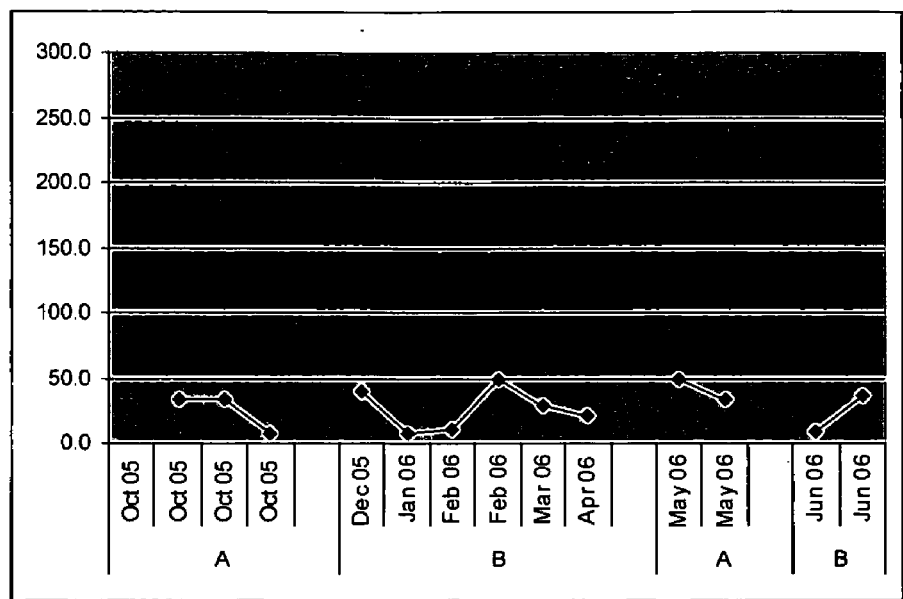
Findings:

No gains in *participation*

Possible gains in norm-referenced expressive language (+2 CI-o)

No gains in norm-referenced receptive vocabulary (-2 CI-o)

Decrease in *grammatical correctness*

Intervening variables:

- She was assessed with the CELF-P 2000 version prior to intervention and with the CELF-P2 2005 version post-intervention (see chapter three).

- There was a significant discrepancy between the number of utterances produced by her in the baseline and in each of the intervention phases.

Decrease in *grammatical correctness* during intervention phases was probably attributed to increased number of utterances (and clausal utterances) produced by her after the introduction of intervention.

- She received a greater number of teacher's obligations after the introduction of intervention.

- Lesson content: She produced the greatest proportion of *pragmatically inappropriate* and *inadequate responses* in the 2ⁿᵈ intervention phase.

Teacher posed more cognitively challenging questions towards the end of the school year (e.g., *How are you different from other people; How will you learn what you are going to have for your dinner*). See 'Intervening variables' in a case study of child B3 from this class for elaboration.

- Lesson content: 4ᵗʰ baseline recording

Teacher introduced a story time and required story analysis and synthesis (e.g. *How would she feel if she were lost*).

- Lesson content: 2ⁿᵈ intervention recording

There was a discussion about birds in winter and story time during that lesson. Teacher posed cognitively demanding questions (e.g., *How are the rowing boats different to the sailing boats; Why might she be getting water in her bucket*).

- Lesson content: 3ʳᵈ intervention recording

There was a discussion around pictures of a farm during that lesson. It was a

vocabulary demanding lesson as the teacher posed questions such as, *What do we call this boat; Does anybody know what kind of birds they are?*

Conclusion:

Some small norm-referenced gains were noted in expressive language. She was reassessed with a different version of a test post-intervention (which was standardised in the Irish context). Furthermore, she was only three years old at the baseline assessment (static assessments are considered to be less valid for very young children). The baseline language sample was not rich in utterances. It can be concluded that there is no evidence of gains from the intervention for this child.

Table B1.5. Profile: <u>Child B5</u>

Gender	Female
Age at the start of intervention	4 years 5 months
Language skills pre-intervention	Severe expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every day the researcher arrived

Figure B2.5. **Responsiveness** and **Pragmatic appropriateness** score pre-intervention (A) and after the introduction of intervention (B)[81]
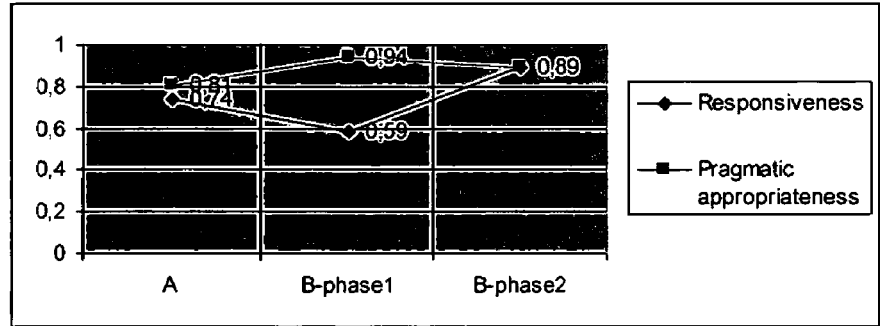
Findings:

Clear gains in *pragmatic appropriateness*

No gains in *responsiveness*/No clear pattern

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[81] (A): 4 recordings, (B1): 3 recordings, (B2): 4 recordings

Figure B4.5. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
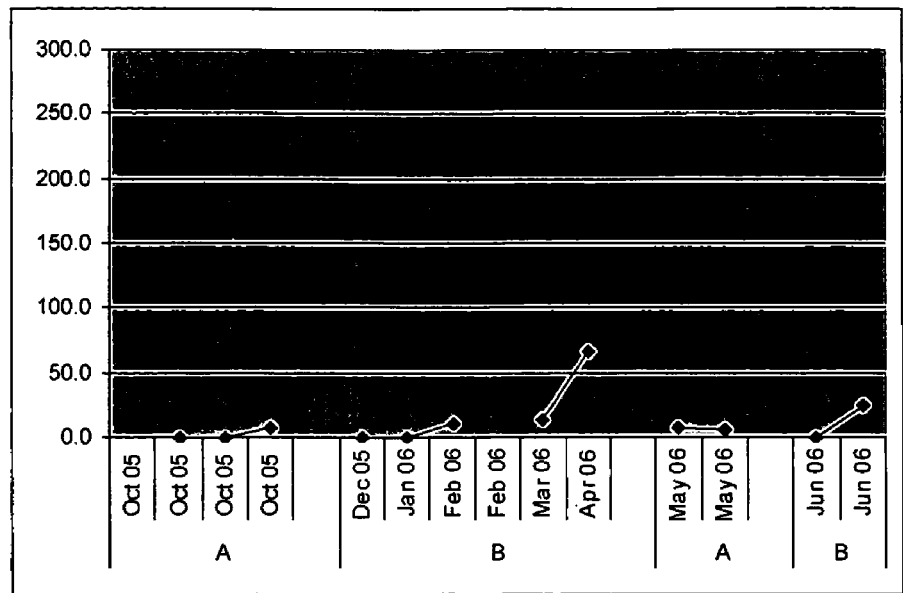
Findings:

Some small gains in *participation*

Clear gains in norm-referenced expressive language (+4 CI-no)

No gains in norm-referenced receptive vocabulary (-7 CI-o)

Decrease in *grammatical correctness*

Intervening variables:

- She reduced final consonants (e.g. –s for plurals or possessives) during the baseline assessment. Her speech intelligibility improved at the end of the study and this could have resulted in the higher score on the Word Structure subtest (sub-domain of expressive language).

- Her *responsiveness* was lower in the 1st intervention phase when she received more teacher obligations (see appendix F for data on the number of teacher obligations).

- Lesson content: her *pragmatic appropriateness* score decreased in the 2nd intervention phase. Teacher posed more cognitively challenging questions towards the end of the school year (e.g., *How are you different from other people; How will you learn what you are going to have for your dinner*).

See 'Intervening variables' in a case study of child B3 from this class for elaboration.

Conclusion:

It is likely that the intervention supported the comprehension of the teacher's questions/obligations as a higher proportion of this child's responses were pragmatically appropriate and adequate in the intervention phase. Her responsiveness, however, decreased in the 1st intervention phase and some researchers analyse these two dimensions in conjunction (e.g., Adams, 2006). Gains in a norm-referenced expressive language total score might have been attributable to improved speech intelligibility (as outlined above). In the absence of SLT services during the study, it is possible that SFA supported the improvement in speech intelligibility for this child. It can also be concluded that pragmatic appropriateness gains were likely supported by the intervention.

Table B1.6. Profile: <u>Child B6</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	5 years
Auxiliary services during the study	No
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary He was not re-assessed post-intervention as he left the school before the study was completed
Family situation during the study	He moved out of the area and changed the school before the study was completed
Exposure to intervention	8 months
Teacher's use of microphone	Teacher wore the microphone every day the researcher arrived

Figure B2.6. <u>Responsiveness</u> and <u>Pragmatic appropriateness</u> score pre-intervention (A) and after the introduction of intervention (B)[82]
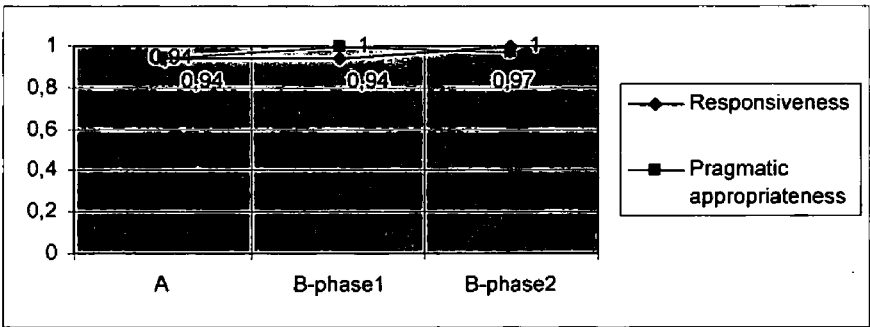
Findings:

Gains in the 2nd intervention phase in *responsiveness*

Possible gains in *pragmatic appropriateness*

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[82] (A): 4 recordings, (B1): 3 recordings, (B2): 2 recordings

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Figure B4.6. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
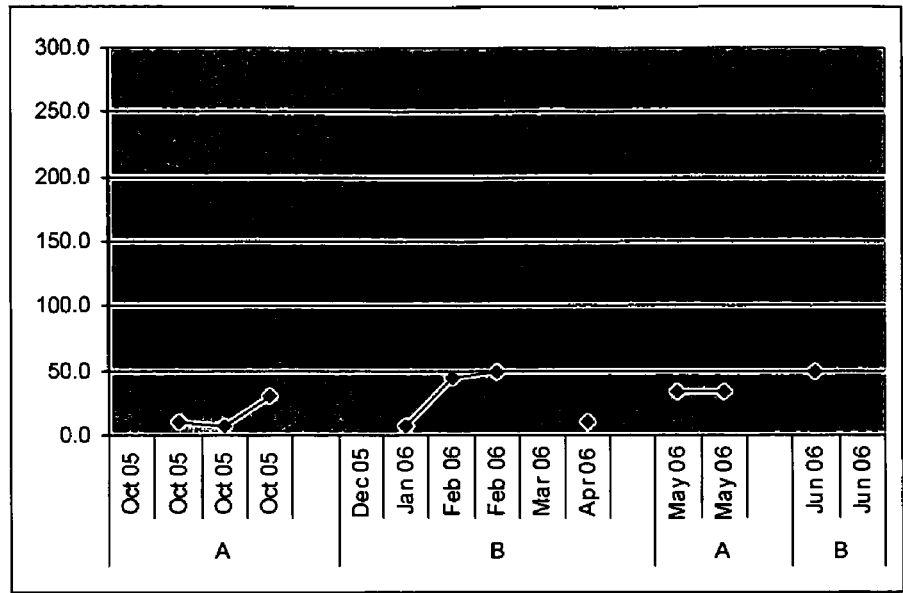
Findings:

Some small gains in *participation* although no clear consistent pattern

Clear gains in *loquacity*

Gains in the 2nd intervention phase in *syntactic complexity*

No gains in *grammatical correctness*/No clear pattern

Intervening variables:

- Lesson content: His *pragmatic appropriateness* score decreased slightly in the 2nd intervention phase.

Teacher posed more cognitively challenging questions towards the end of the school year (e.g., *How are you different from other people*). See 'Intervening variables' in a case study of child B3 from this class for elaboration.

- Teacher reported that he missed school often.

He was absent during three out of 14 total number of recordings. He was observed to have lower *responsiveness* and lower *participation* after prolonged absence from school and this is reflected in the participation pattern. His *participation* was the lowest after the periods of his absence (which are 'marked' by gaps in data points).

Conclusion:

Immediate gains were noted in the intervention phase on *pragmatic appropriateness* and *loquacity* dimensions. Gains in the 2nd intervention phase were noted on *syntactic complexity* and *responsiveness* dimensions. The richness and characteristics of the language sample, teacher's stimulus, lesson content and lesson format were relatively consistent across the study phases. Thus, it may be concluded that the intervention benefited this child, as he provided longer contributions that were more pragmatically appropriate and adequate immediately after the introduction of the intervention.

School 1, Class L, senior infants

Table L.1. Profile: Class L

Geographical area	Ballyfermot
Age of the class	Senior infants
Start of the intervention	SFA installed at the end of junior infants (Jun)
Group/Class size (averaged from all recordings)	14 (<15; 'small')
Classroom size (inter-observer agreement)	Small room
Teacher's use of SFA	Teacher wore the microphone every day the researcher arrived

Narrative for the class

The teacher of class L created a discourse type conforming to the traditional Initiation-Response-Feedback model (see glossary). The teacher conducted the turn-taking in class discussions and discouraged spontaneous initiations. She posed many closed type questions and did not create an interactive context for dialogic reading of stories. The recorded lessons included labeling activities, poster discussion activities and non-dialogic story reading lessons followed by questions and/or class discussion. Some elements of phonics instruction were also recorded.

Class summary

There were almost no norm-referenced language gains reported in this class and no gains noted in syntactic complexity and loquacity. Two children made gains in pragmatic appropriateness, grammatical correctness and participation (children L2, L3). Only one child showed gains in both norm-referenced and classroom derived dimensions, however one must be cautious about attributing this child's large increase of 17 standardized points in norm-referenced language score to the intervention (see case study of child L4).

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Table L1.1. Profile: <u>Child L1</u>

Gender	Female
Age at the start of intervention	5 years 4 months
Language skills pre-intervention	Moderate expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	11 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure L3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[83]
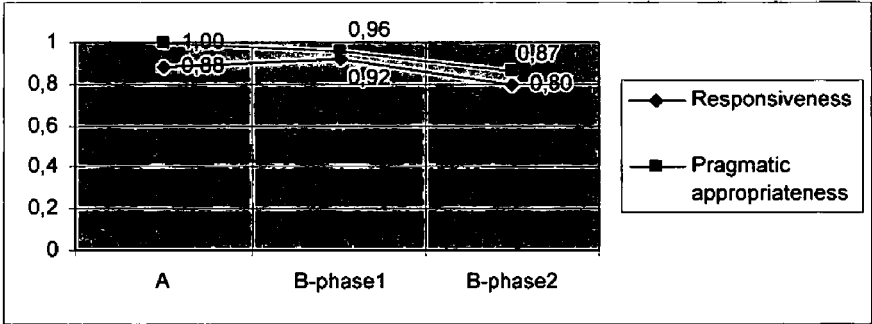
Findings:

No gains in *responsiveness*; No clear pattern

Decrease in *pragmatic appropriateness*

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[83] (A): 3 recordings, (B1): 4 recordings, (B2): 4 recordings

Figure L4.1. Participation pre-intervention (A) and after the introduction of intervention (B)
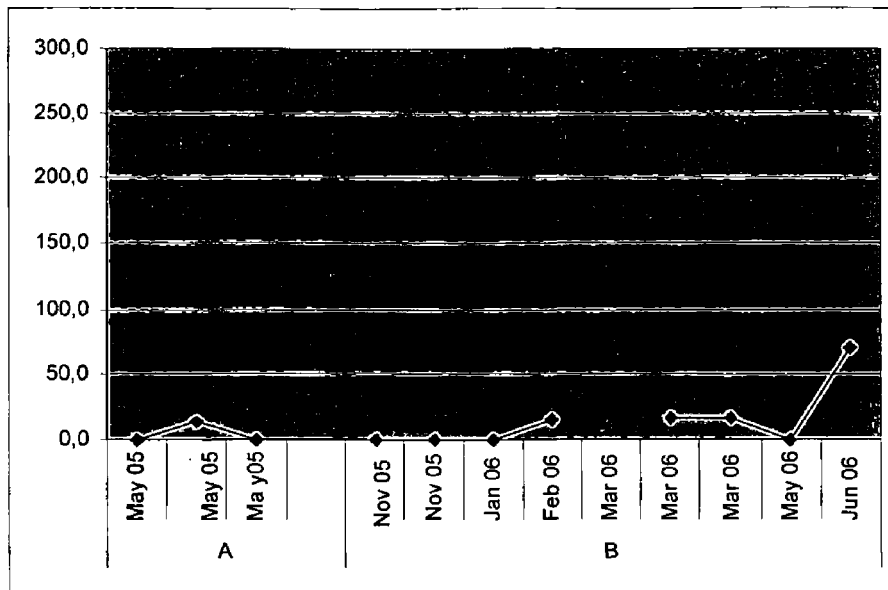
Findings:

No gains in *participation*/Not clear pattern

Probable gains in norm-referenced receptive vocabulary (+2 CI-o)

Gains in the 2nd intervention phase in *loquacity*

No change in norm-referenced expressive language

No gains in *syntactic complexity*

No change in *grammatical correctness*

Intervening variables:

- She produced a comparable number of utterances in the baseline and in the 1st intervention phase but many more utterances in the 2nd intervention phase.

Increase in *loquacity* score in the 2nd intervention phase could have been partly related to increased number of utterances. Increased *loquacity* score might have impacted in turn on *grammatical correctness* score. The increased number of utterances in the 2nd intervention phase was partly attributable to the increased number of teacher obligations directed towards her as well as to a higher number of volunteered utterances produced.

- Pre-intervention recordings took place in junior infants (May 05) and intervention recordings took place in senior infants (from Nov 05). Both classes had the same teacher.

- She failed to provide responses when asked to label objects (e.g., *What do you call them)* and to recall information (e.g., *What did mammy do; What did they think of)* both pre-intervention and after the introduction of intervention.

Some questions directed towards her contained words that were unlikely to be part of her vocabulary repertoire (e.g., *You are a dentist; What are you going to examine*). She failed to provide responses to these questions.

- Lesson content: Phonics lesson during 9th intervention recording

Children were required to provide examples of words starting with particular phonemes. Such instruction could invite multiple responses.

Conclusion:

Some gains were noted on norm-referenced receptive vocabulary. Observation of gains needs to be qualified by the recognition that the confidence intervals were overlapping. The receptive vocabulary test used in this study (BPVS-II) has a wide-ranging confidence interval (extending six points below and above the child's actual score). In the absence of other language gains, it cannot be concluded that the intervention benefited the language performance of this child.

School 1, class L, senior infants

Table L1.2. Profile: <u>Child L2</u>

Gender	Female
Age at the start of intervention	4 years 9 months
Language skills pre-intervention	Moderate expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	11 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure L3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[84]
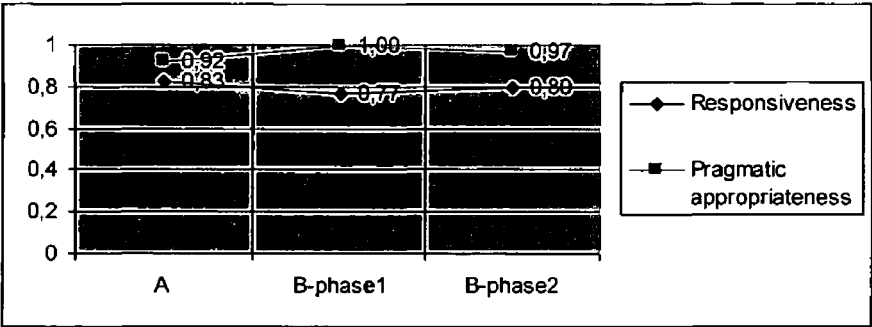
Findings:

Probable gains in *pragmatic appropriateness*

Decrease in *responsiveness*

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[84] (A): 3 recordings, (B1): 4 recordings, (B2): 5 recordings

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Figure L4.2. Participation pre-intervention (A) and after the introduction of intervention (B)
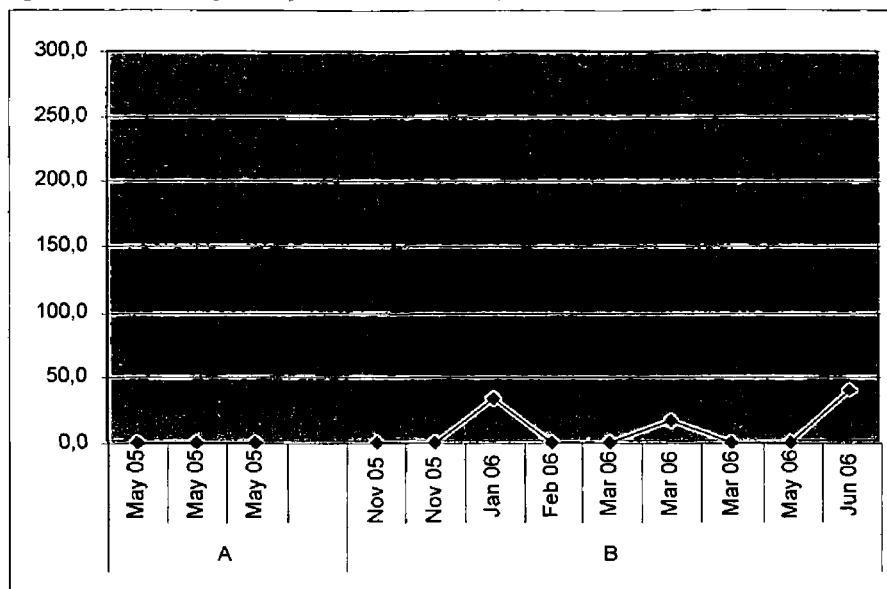
Findings:

Some small gains in *participation* though no clear consistent pattern

Clear gains in *grammatical correctness*

No gains in norm-referenced expressive language (-2 CI-o)

No gains in norm-referenced receptive vocabulary (-6 CI-o)

Intervening variables:

- Linguistic material produced by her pre-intervention and in the 1st intervention phase was comparable but she produced more utterances in the 2nd intervention phase.

A decrease in *grammatical correctness* score in the 2nd intervention phase could have been partly due to the increase in the wealth of linguistic material.

- Pre-intervention recordings took place in junior infants (May 05) and intervention recordings took place in senior infants (from Nov 05). Both classes had the same teacher.

- Lesson content: Phonics lesson during 9th intervention recording

See 'Intervening variables' in a case study of child L1 from this class for elaboration.

Conclusion:

Gains were noted in *pragmatic appropriateness* and *grammatical correctness* dimensions, and some small gains were noted in *participation*. These gains need to be qualified by the recognition that the study lasted longer than one school year in this class (the baseline was recorded at the end of junior infants and the intervention phase was recorded in senior infants). No gains were noted on norm-referenced dimensions. Thus, it cannot be concluded that the small gains recorded in the classroom were attributable to the intervention.

School 1, class L, senior infants

Table L1.3. Profile: <u>Child L3</u>

Gender	Female
Status	Attention difficulties
Age at the start of intervention	5 years 1 month
Language skills pre-intervention	Within norms for age expressive language
	Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	11 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone every time
	the researcher arrived

Figure L3.3. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[85]
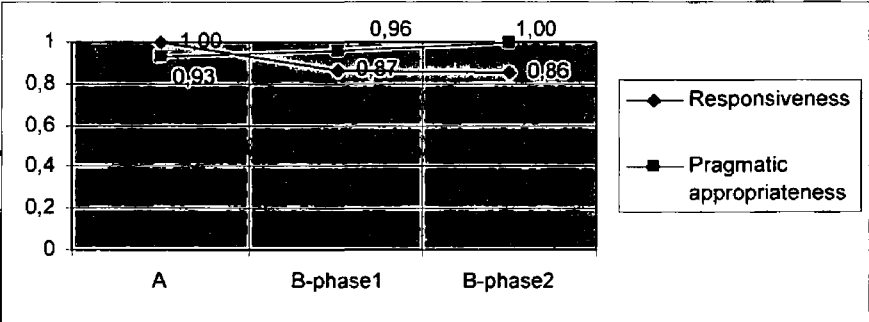
Findings:

Clear gains in *pragmatic appropriateness*

Decrease in *responsiveness*

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[85] (A): 3 recordings, (B1): 4 recordings, (B2): 5 recordings

Figure L4.3. Participation pre-intervention (A) and after the introduction of intervention (B)
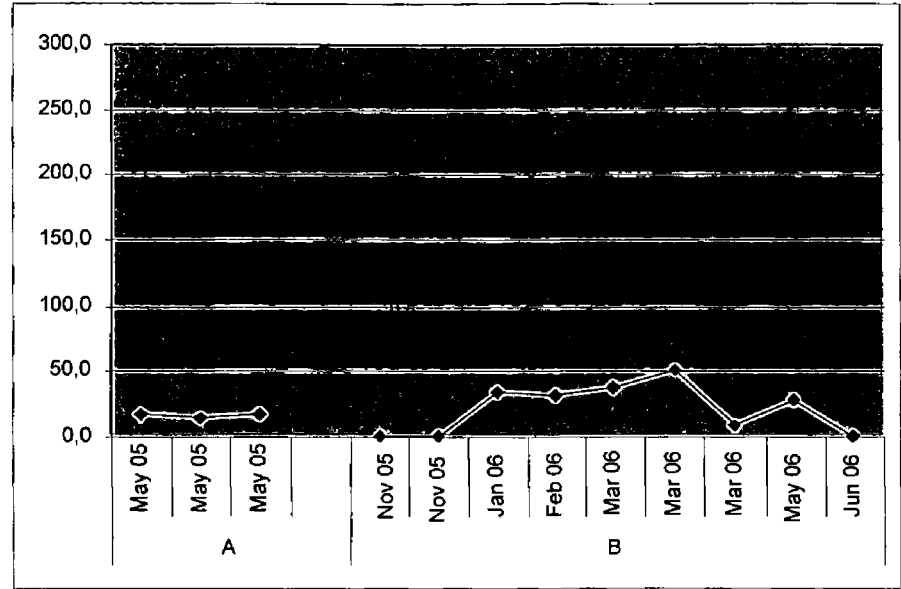

Findings:

Probable gains in *participation*

Her *participation* increased slightly from the 3rd intervention recording and remained higher than during the baseline for a few months. She did not participate almost at all during 4 lessons in the intervention phase (1st, 2nd, 7th and 9th recording). No lesson content factors were found that could have affected her participation levels during those three lessons. It might have been that it was personal problems that affected this child's participation in class during those three lessons. However, there is no evidence to support this.

Clear gains in *grammatical correctness*

Probable gains in norm-referenced receptive vocabulary (+2 CI-o)

No gains in norm-referenced expressive language (-2 CI-o)

No change in *syntactic complexity*

Decrease in *loquacity*

Intervening variables:

- The number of clause utterances produced by her was the same pre-intervention (A) and in the 1st intervention phase (B1), but higher in the 2nd intervention phase (B2).

The increased number of utterances in the 2nd intervention phase might have been partly attributable to the increased number of teacher obligations directed towards her, as well as to the fact that she volunteered more responses in the intervention phase at the end of the study.

- Pre-intervention recordings took place in junior infants (May 05) and intervention recordings took place in senior infants (from Nov 05). Both classes had the same teacher.

Conclusion

Clear gains were noted on two dimensions, namely *grammatical correctness* and *pragmatic appropriateness*. Some small gains were noted in participation and norm-referenced receptive vocabulary. Considering that there were only a few intervening variables noted, it can be concluded that the intervention was likely to contribute to the observed language gains. This conclusion needs to be qualified by the recognition that baseline abilities were observed in this particular class (class L) at the end of junior infants and the intervention recordings were collected when this class was already in senior infants.

Table L1.4. Profile: <u>Child L4</u>

Gender	Female
Age at the start of intervention	5 years 3 months
Language skills pre-intervention	Moderate expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	11 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure L3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[86]
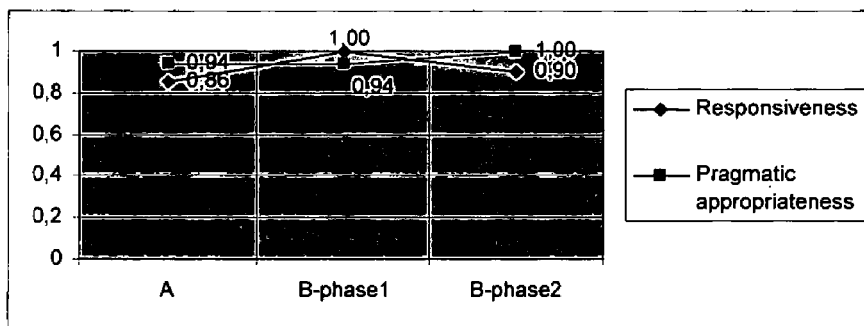
Findings:

Gains in the 2nd intervention phase in *pragmatic appropriateness*

Probable gains in *responsiveness* (scores in both intervention phases are higher than score in the baseline. Some decrease in the 2nd intervention phase can be observed)

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[86] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings

Figure L4.4. Participation pre-intervention (A) and after the introduction of intervention (B)
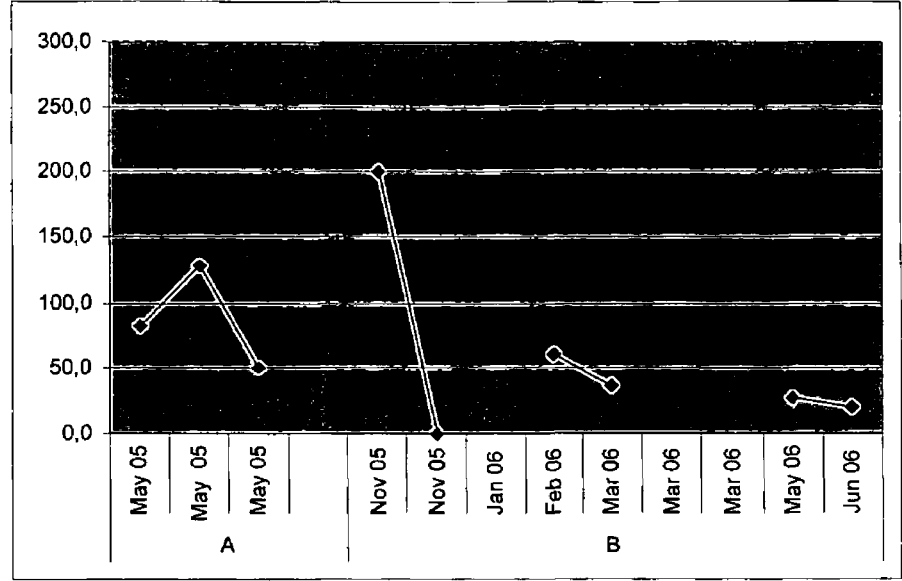
Findings:

No gains in *participation*/Not clear pattern

Clear gains in norm-referenced expressive language (+17 CI-no)

Not immediate gains in *grammatical correctness*

No gains in norm-referenced receptive vocabulary (-3 CI-o)

Decrease in *loquacity*

Decrease in *syntactic complexity*

Intervening variables:

- Pre-intervention recordings took place in junior infants (May 05) and intervention recordings took place in senior infants (from Nov 05). Both classes had the same teacher.

- Teacher directed increased attention towards her pre-intervention (as quantified by the number of teacher obligations directed towards her compared to the number of teacher questions directed towards the whole class; see chapter three).

- She was absent during the 3rd, 6th and 7th intervention recordings and, according to her teacher, had inconsistent in-school attendance.

Lower participation scores in the intervention phase might have been affected by the fact that this child missed school more often during the intervention phase. A high participation score during the first recording in the intervention phase might have reflected a 'novelty' effect.

Conclusion:

Responsiveness and *pragmatic appropriateness* were analysed together by some researchers (e.g., Adams *et al.*, 2006) who studied children with communication difficulties of the pragmatic type. When analysed together in this child's case, gains can be seen in both intervention phases, despite an unclear/variable pattern of single dimensions. A gain of 17 standardised points in norm-referenced expressive language total score is very unusual and may be due to a range of other factors such as greater attention and metalinguistic skills as well as lower distractibility at the post-intervention assessment. As gains were noted in both static and dynamic language profiles, it can be concluded that SFA was likely to support the occurrence of these gains.

School 2: DEIS Band 1 school

Class J, junior infants

Table J.1. Profile: Class J

Geographical area	Ballyfermot
Age of the class	Junior infants
Start of the intervention	SFA installed at the start of school year (Nov)
Group/Class size (averaged from all recordings)	13 (<15; 'small')
Classroom size (inter-observer agreement)	Small room
Teacher's use of SFA	Teacher wore the microphone 4 days out of 6 the researcher arrived

Narrative for the class

The teacher of class J was observed to make a good use of language stimulation techniques, especially language modeling, recasting and evaluating of children's responses. She did not, however, encourage children's spontaneous contributions and did not shift power relations towards the children. A majority of the videotaped lessons in this class were story time lessons, with a story 'Going on a bear hunt' videotaped three times. Phonics instruction was recorded to be taught in a decontextualised way (see chapter six for elaboration).

Class summary

Gains in norm-referenced expressive language and receptive vocabulary were noted for 4 children in this class, however, there were very little gains noted in the classroom. No gains in responsiveness, pragmatic appropriateness, syntactic complexity and loquacity were noted, while some small gains in participation could have been attributed to the lesson content (see case studies of child J3 and child J4). In the absence of clear gains in the classroom, it is not possible to conclude that the norm-referenced language gains were attributable to SFA.

Table J1.1. Profile: <u>Child J1</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	4 years 4 months
Language skills pre-intervention	Within norms for age receptive language Within norms for age receptive vocabulary
Auxiliary services during the study	Weekly resource hours in school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure J3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[87]
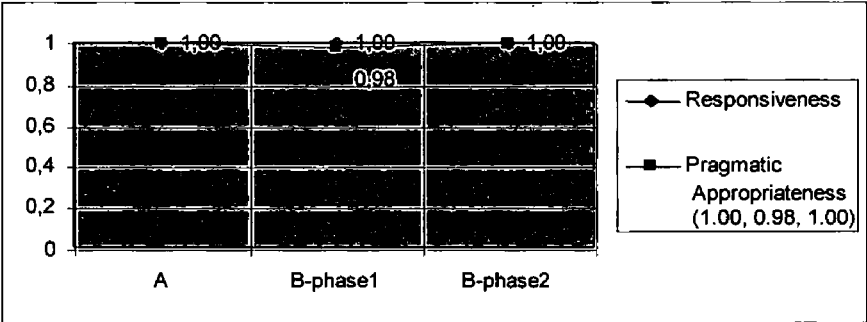
Findings:

No change in *responsiveness*

No significant change in *pragmatic appropriateness*

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[87] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings

Figure J4.1. Participation pre-intervention (A) and after the introduction of intervention (B)
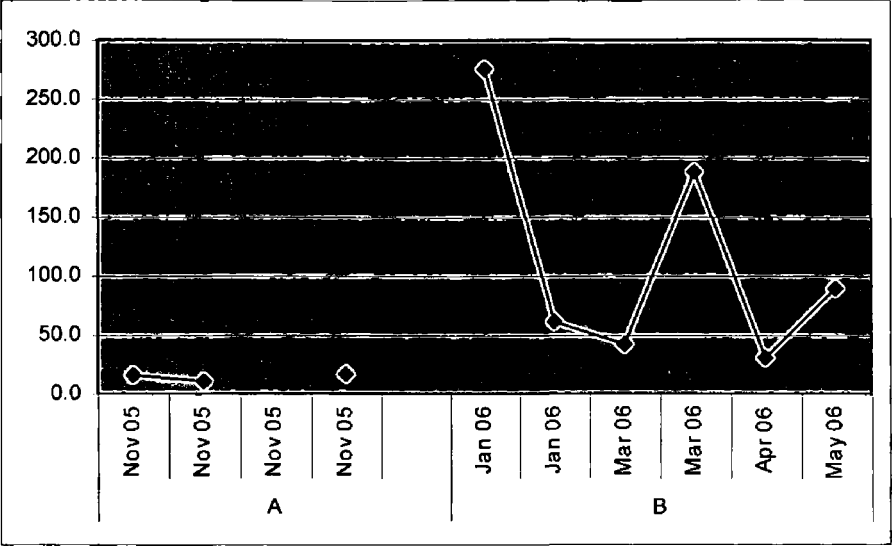
Findings:

Clear gains in *participation*

Clear gains in norm-referenced expressive language total score (+4 CI-no)

Clear gains in *grammatical correctness*

Probable gains in norm-referenced receptive vocabulary (+11 CI-o)

No change in *loquacity*

No change in *syntactic complexity*

Intervening variables:

- Lesson content: Familiar story during 1st intervention recording

Teacher introduced a story, 'Going on a bear hunt'. The same story was presented to this class during the 2nd baseline recording and his familiarity with it could have positively influenced his performance. He anticipated what was about to happen in the story. High level of *participation* during 1st intervention recording was noted also for other study participants from this class.

- New behaviour management system during 4th intervention recording

A new behaviour management system was introduced in the classroom on the day of the scheduled recording. He was sitting at a separate table (as 'a warning') when the researcher arrived. Before the recording started he had been asked to go back to his seat and 'listen'. It is likely that this impacted on his *participation* level. Positive change in *participation* during that lesson was noted also for two other study participants from this class: child J4 and child J2.

- He was slightly inattentive during the pre-intervention assessment but he concentrated well during the post-intervention assessment.

- He produced more utterances in the 1st intervention phase than in any other study phase.

- He received more teacher obligations in the intervention phases.

Conclusion:

This child began contributing more frequently to the classroom discourse and producing more grammatically correct utterances after SFA installation. Norm-referenced results of both receptive vocabulary and expressive language also show clear gains. It can be concluded that the intervention probably benefited this child's language performance. This observation of gains needs to be qualified by the recognition that the teacher posed more obligations towards this child in the intervention phase, i.e. she directed more attention towards him. Additionally, these language gains could have been partly attributable to the resource hours this child attended regularly every week for the duration of the study.

Table J1.2. Profile: Child J2

Gender	Female
Age at the start of intervention	5 years
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone 4 days out of 6 the researcher arrived

Figure J3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[88]
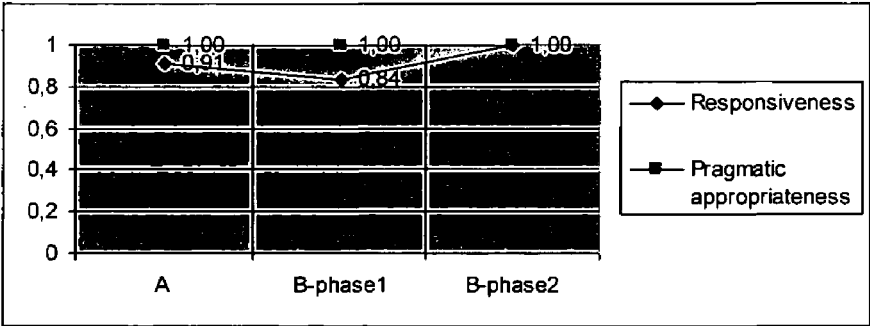
Findings:

Gains in *responsiveness* in the 2nd intervention phase, but unclear pattern

No change in *pragmatic appropriateness*

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[88] (A): 4 recordings, (B1): 3 recordings, (B2): 3 recordings

Figure J4.2. Participation pre-intervention (A) and after the introduction of intervention (B)[89]
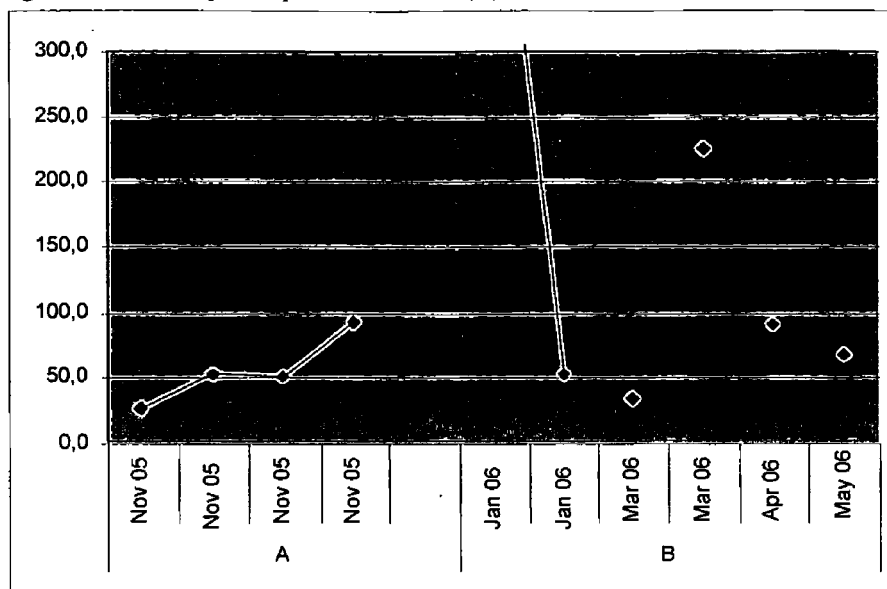
Findings:

Some small gains in *participation* though no clear consistent pattern

Clear gains in norm-referenced expressive language (+13 CI-no)

Probable gains in norm-referenced receptive vocabulary (+11 CI-o)

No gains in *loquacity*

No gains in *syntactic complexity*

No change in *grammatical correctness*

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[89] Participation score in the 2nd intervention recording was 400.0.

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Intervening variables:

- She received more teacher obligations in the 1st intervention phase. She also volunteered more responses after the SFA installation.

This resulted in a richer language sample in the 1st intervention phase. Perhaps the increased number of teacher obligations in the 1st intervention phase influenced her responsiveness score. Responsiveness score and the number of teacher obligations appear to be negatively correlated in this child's case.

- The lesson content varied across individual recordings.

Teacher introduced different activities, including English lessons (story time, poster descriptions and phonics activities) and elements of mathematics.

- Lesson content: Familiar story during 1st intervention recording

See 'Intervening variables' in a case study of child J1 from this class for elaboration.

- 4th intervention recording: a new behaviour management system was introduced in the classroom.

She participated more willingly during the lesson with the new behaviour management system than during other lessons. Positive change in *participation* during this lesson was noted also for two other study participants from this class: child J4 and child J1.

Conclusion:

Gains were noted in norm-referenced expressive language total score and norm-referenced receptive vocabulary. Most language dimensions observed within the classroom context show an unclear pattern (perhaps due to the changing lesson content and the varying number of teacher obligations directed towards her). It is thus not possible to conclude the SFA contribution to language gains for this child.

Table J1.3. Profile: <u>Child J3</u>

Gender	Female
Age at the start of intervention	4 years 7 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure J3.3. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[90]
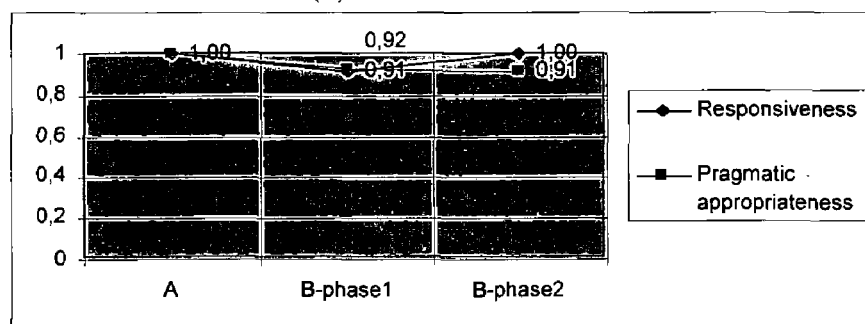
Findings:

No gains in *responsiveness*/Not clear pattern

Decrease in *pragmatic appropriateness*

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[90] (A): 4 recordings, (B1): 3 recordings, (B2): 3 recordings

Figure J4.3. Participation pre-intervention (A) and after the introduction of intervention (B)
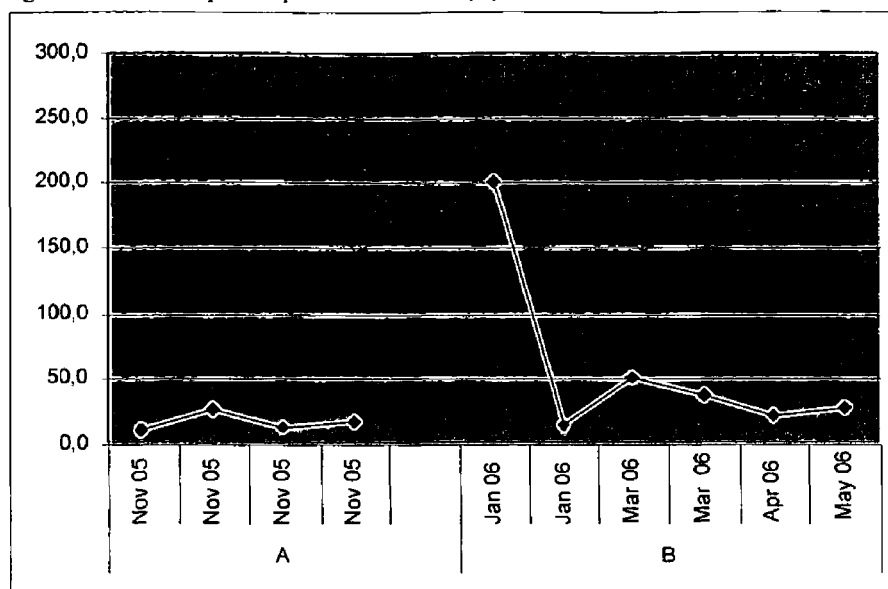
Findings:

Probable gains in *participation*

Her *participation* increased significantly during the first lesson recorded after the introduction of intervention. It then decreased again, but during the 3rd and 4th intervention recordings it was slightly higher than during the baseline.

Clear gains in norm-referenced expressive language (+5 CI-no)

No change in norm-referenced receptive vocabulary

No change in *loquacity* and *syntactic complexity*

No change in *grammatical correctness*

Intervening variables:

- Lesson content varied across lessons and changed especially in the 2nd intervention phase when elements of maths were introduced. This change affected the characteristics of the language sample in the 2nd intervention phase. The proportion of word level utterances in the 2nd intervention phase was higher as a result. The number of word level utterances is negatively correlated with the number of clause utterances in this study phase (B2).

- She received more teacher obligations in the 1st intervention phase, similar to other study participants from this class.

- Lesson content: Familiar story during the 1st intervention recording

See 'Intervening variables' in a case study of child J1 from this class for elaboration.

Conclusion:

Clear gains were noted in the norm-referenced expressive language total score. Some gains were observed also in the participation dimension. However, the highest participation gains were most likely related to the lesson content (see intervening variables). She did not produce any multi-clausal utterances throughout the whole study. In the absence of clear gains in the classroom, it is not possible to conclude that norm-standardised language gains were attributable to SFA.

Table J1.4. Profile: Child J4

Gender	Female
Age at the start of intervention	4 years 5 months
Language skills pre-intervention	Moderate expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure J2.4.Pragmatic appropriateness score pre-intervention (A) and after the introduction of intervention (B)[91]
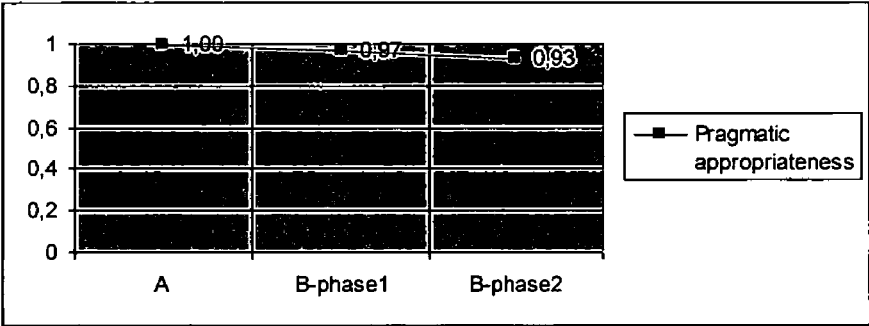
Findings:

Clear decrease in *pragmatic appropriateness*

[91] (A): 4 recordings, (B1): 3 recordings, (B2): 3 recordings

Figure J4.4. Participation pre-intervention (A) and after the introduction of intervention (B)
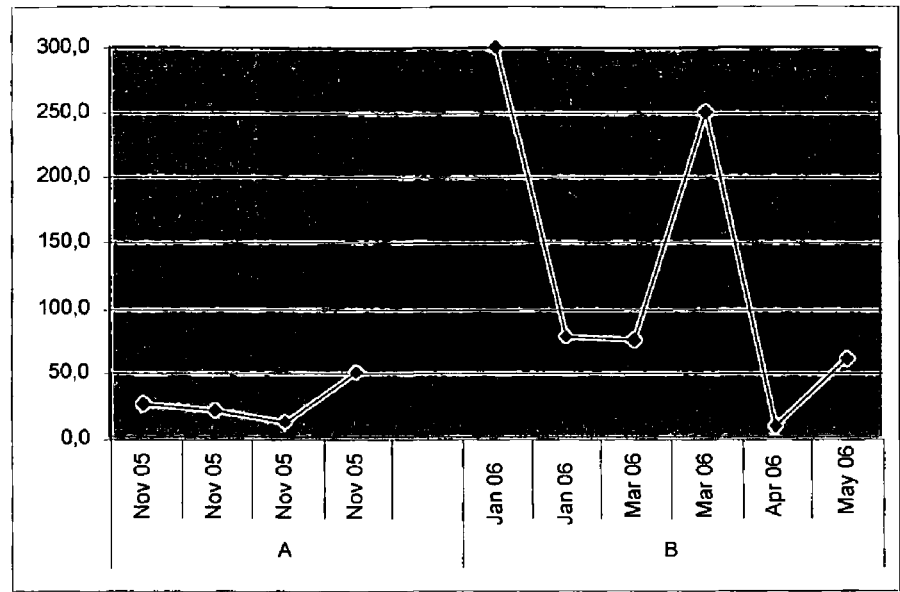
Findings:

Clear gains in *participation*

Her *participation* increased significantly during the 1st intervention recording after the introduction of intervention; it was also very high during 4th intervention recording. During the remaining intervention lessons, her *participation* level was lower than during the 1st and 4th intervention lessons but still higher than during the baseline with the exception of the second last recording in the intervention phase.

Gains in the 2nd intervention phase in *grammatical correctness*

No gains in norm-referenced expressive language (-6 CI-no)

No change in norm-referenced receptive vocabulary

No change in *loquacity* and *syntactic complexity*

Intervening variables:

- She produced more utterances in the 1st intervention phase, similar to other study participants from this class.

- Lesson content varied across lessons and changed especially in the 2nd intervention phase as elements of maths were introduced.

This change affected the characteristics of the language sample in the 2nd intervention phase. There were more word level utterances in the 2nd intervention phase. Increase in grammatical correctness in this phase was likely due to the fact that a significant number of utterances were word level utterances (these are less likely to be erroneous).

- She received more teacher obligations in the intervention phases, especially in the 1st intervention phase, than in the baseline.

- Lesson content: Familiar story during 1st intervention recording

See 'Intervening variables' in a case study of child J1 from this class for elaboration.

- New behaviour management system during 4th intervention recording

See 'Intervening variables' in a case study of child J1 from this class for elaboration.

Conclusion:

Clear gains were noted in *participation*. This observation of gains needs to be qualified by the recognition of the intervening factors outlined above, i.e. participation was highest during two lessons, one when a new behaviour management system was introduced, and the other during the familiar content lesson. Gains in *grammatical correctness* were not immediate and likely related to the change in language sample characteristics. This child also received increased teacher's attention in the intervention phase. There were no norm-referenced gains noted. The presence of a number of intervening variables, coupled with the absence of norm-referenced gains, suggest that the observed gains cannot be attributable to the intervention.

School 2, class J, junior infants

Table J1.5. Profile: <u>Child J5</u>

Gender	Male
Age at the start of intervention	4 years 4 months
Language skills pre-intervention	Moderate expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	Weekly resource hours in school from March06 onwards
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure J2.5. **Responsiveness** and **Pragmatic appropriateness** score pre-intervention (A) and after the introduction of intervention (B)[92]
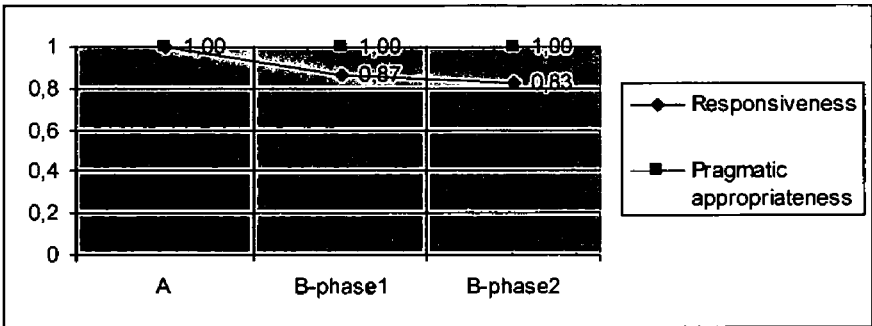
Findings:

No change in *pragmatic appropriateness*

Clear decrease in *responsiveness*

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[92] (A): 4 recordings, (B1): 2 recordings, (B2): 3 recordings

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Figure J4.5. Participation pre-intervention (A) and after the introduction of intervention (B)
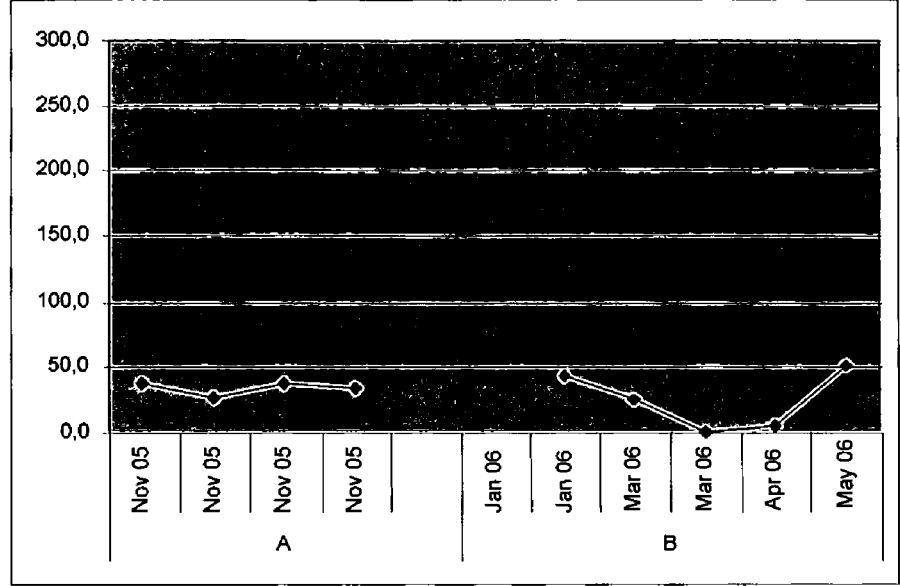
Findings:

No gains in *participation*

Possible gains in norm-referenced receptive vocabulary (+4 CI-o)

No gains in norm-referenced expressive language total score (-3 CI-o)

No change in *loquacity* and *syntactic complexity*

No change in *grammatical correctness*

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Intervening variables:

- Linguistic material produced by him pre-intervention and after the introduction of intervention was comparable in the baseline and the 2nd intervention phase. However, he produced more utterances in the 1st intervention phase.

- Lesson content varied across lessons and changed especially in the 2nd intervention phase. That change affected the characteristics of the language sample in the 2nd intervention phase.

Teacher introduced elements of maths in the last 2nd intervention phase, which resulted in an increased proportion of word level utterances.

- He received more teacher obligations in the intervention phases than in the baseline.

Perhaps a decrease in the *responsiveness* score in the intervention phases could be partly attributed to the increased number of teacher obligations he was faced with.

- He was observed walking around the classroom during activities such as story time or circle time. This was noted throughout all observations, regardless of whether the teacher's voice was amplified or not.

Conclusion:

An increase of four standardised points was noted at the post-intervention assessment in the norm-referenced receptive vocabulary test. However, the observation of receptive vocabulary gains needs to be qualified by the recognition that the confidence intervals of pre- and post-intervention assessments were overlapping. The confidence interval at around a single score in this test extends widely, six standardised points above and below the actual score. No gains were noted on other dimensions. In the absence of gains on any other dimension, it cannot be concluded that SFA benefited this child.

School 2, class A, senior infants

Table A.1. Profile: Class A

Geographical area	Ballyfermot
Age of the class	Senior infants
Start of the intervention	SFA installed at the end of junior infants (Jun)
Group/Class size (averaged from all recordings)	20 (>15, 'large')
Classroom size (inter-observer agreement)	Large room
Teacher's use of SFA	Teacher wore the microphone on 10 days out of 12 the researcher arrived

Narrative for the class

The teacher of class A was observed to consistently display the elements of good quality of language teaching, including the use of language stimulation techniques, posing frequent open-ended questions and shifting power relations towards the children in the context of dialogic book reading. Children in this class were given a choice of books to read. The teacher was observed to read out elements of some lessons from English language manuals presenting exemplary English language lessons. All lessons in the intervention phase were recorded in the context of a picture book or a poster discussion. Elements of phonological instruction were observed during baseline recordings. The differences in the lesson content and the teacher stimuli between the baseline and the intervention phases need to be taken into account when interpreting the observed gains (see case studies of individual children from this class).

Class summary

Gains in a majority of studied dimensions were observed for a majority of children in this class. These included both norm-referenced receptive language gains and gains in participation, responsiveness, loquacity and syntactic complexity. Gains in *all* language dimensions studied, including very clear gains in responsiveness in an ABAB design, were noted for one child from this class (case study A2).

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Table A1.1. Profile: <u>Child A1</u>

Gender	Female
Status	Twin sister of another study participant: Child A2
Age at the start of intervention	5 years 5 months
Language skills pre-intervention	Within norms for age receptive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone on 10 days out of 12 the researcher arrived

Figure A.3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[93]
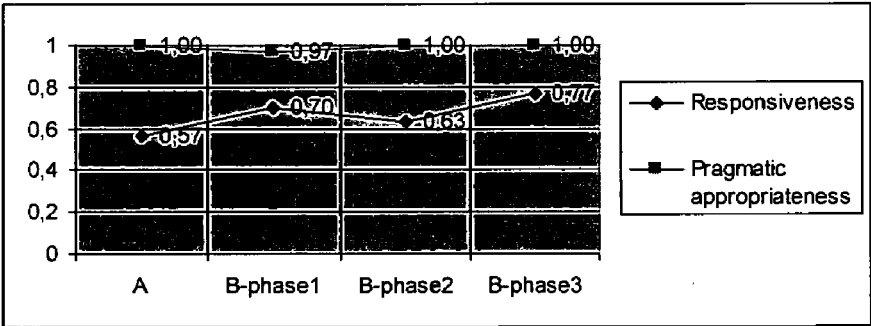
Findings:

Possible gains in *responsiveness*

No gains in *pragmatic appropriateness*

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[93] (A): 3 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 3 recordings

Figure A4.1. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
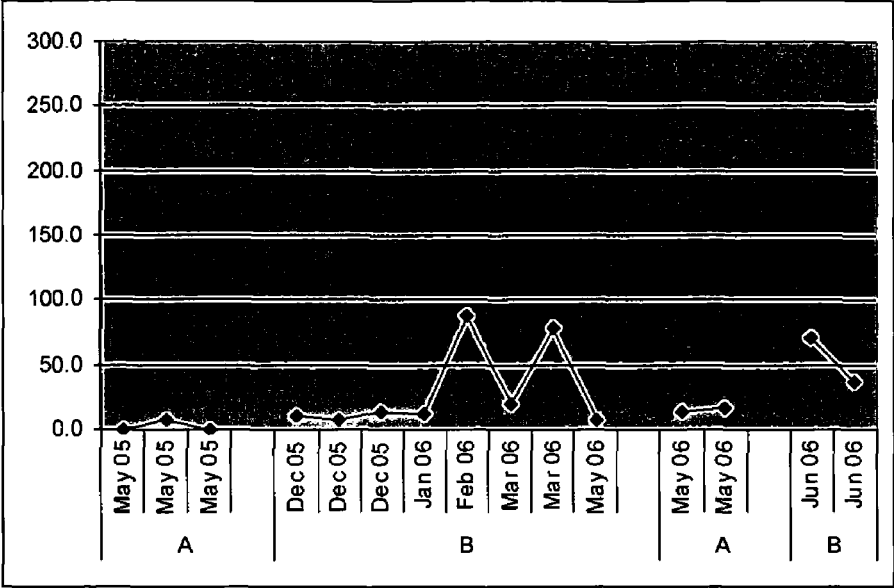
Findings:

Probable gains in *participation*

Her *participation* level did not increase immediately after the introduction of intervention but only since February 06 (irregularly). It then decreased during the withdrawal of intervention and increased with the return of intervention.

Gains in the 2nd intervention phase in *loquacity*

Gains in the 2nd intervention phase in *syntactic complexity*

No change in *grammatical correctness*

Figure A1a.1. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
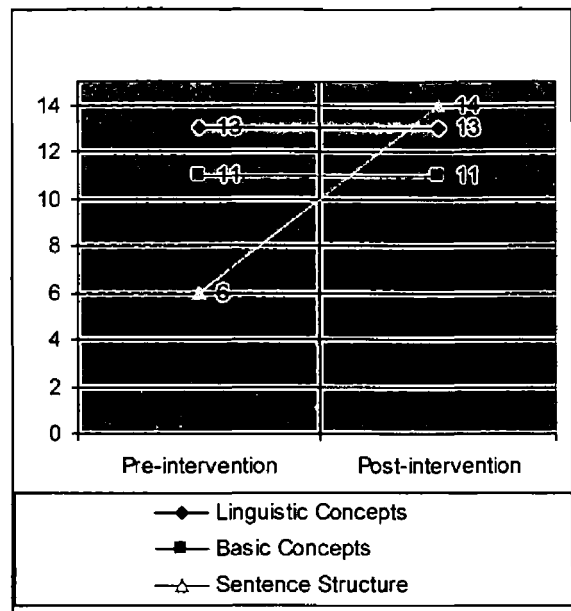
Comments:

The score of 11 on Basic Concepts subtest was the maximum possible score for the relevant age. The score of 13 on Linguistic Concepts subtest was the maximum possible score for the relevant age.

Findings:

Clear gains in norm-referenced receptive language *total score* (+24 CI-no)

Intervening variables:

- The linguistic material obtained in the baseline was much poorer, which was likely attributable to the fact that she almost did not volunteer to participate in the baseline. She also received fewer obligations from her teacher pre-intervention. It is less likely that this was attributable to a lack of confidence as baseline lessons were recorded at the end and not at the start of junior infants.

- A below norm for age score on the pre-intervention Sentence Structure subtest and a very high score after the intervention on the same subtest invite caution when interpreting this gain.

While it might have been that she exhibited a specific delay in the Sentence Structure domain prior to intervention, it is more likely that some other factors (e.g., attention, motivation) impacted on her baseline performance on this subtest (Sentence Structure subtest was administered last at the baseline assessment).

- Significant majority of her utterances in the baseline were single word and phrase utterances; only a few utterances were clausal.

The absence of multi-clausal and syntactically complex units in the baseline could have been partly attributable to the scarcity of linguistic material gathered. On the other hand, however, the linguistic material in the 1st intervention phase was much richer than in the baseline but her scores on *loquacity* and *syntactic complexity* remained the same. This could suggest that she did not produce syntactically complex sentences in the early months of senior infants and that she started to produce them only around the time of the 2nd intervention phase. This could partly explain why at the same time her grammatical correctness score decreased slightly.

- She received fewer teacher obligations in the baseline than she did in either of the intervention phases.

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- Baseline recordings took place at the end of junior infants and intervention recordings took place throughout senior infants. Both classes had the same teacher.

Some lessons were observed to be read out by the teacher from English language manuals presenting exemplary English language lessons.

- Lesson content: *Responsiveness* decreased slightly in the 2nd intervention phase (so did the responsiveness of another child from this class: child A3).

The decrease in *responsiveness* in this phase was influenced mostly by one lesson during which the teacher read a story (Three Little Pigs) and posed questions about the story *after* the story was read. This placed huge demands on memory. Perhaps, this child (and child A3) did not respond to some teacher obligations because they did not remember the story well.

- Lesson content: During the 6th intervention recording children described posters and talked about different jobs. The teacher facilitated the discussion and posed questions regarding the contributions of the other students (e.g., *Who can remember what Sylvia said*).

- Weather: May 06 was a very hot period.

Withdrawal of intervention phase happened to be in May. Participation level was low also during the last recording in the intervention phase (which was recorded in May as well), just before the withdrawal phase. Baseline recordings were obtained in May 05. Although May 05 was not as hot as May 06, the time of the year could have had some impact on the scores.

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Conclusion:

Clear large gains in the norm-referenced receptive language total score were noted at post-intervention assessment. However, gains occurred only on the Sentence Structure subtest of the receptive language and, as the baseline score on this sub-domain was below the norm (while the scores on the other two subtests were well within the norm), it might have been that there was a range of other factors that affected the baseline results (see above for further discussion). It is difficult to judge whether gains on language dimensions observed in the classroom context (*responsiveness* and *participation*) were attributable to the intervention, as there were many intervening variables present. Thus, it cannot be concluded that the observed gains were attributable to the intervention.

Table A1.2. Profile: Child A2

Gender	Female
Status	Twin sister of another study participant: Child A1 Attention difficulties
Age at the start of intervention	5 years 5 months
Language skills pre-intervention	Within norms for age receptive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	16 months
Service fidelity	Teacher wore the microphone on 10 days out of 12 the researcher arrived

Figure A.3.2. **Responsiveness** and **Pragmatic appropr**iateness pre-intervention (A) and after the introduction of intervention (B)[94]
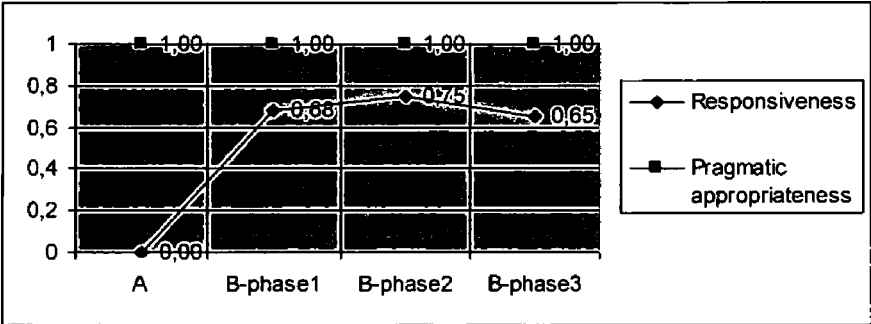
Findings:

Clear gains in *responsiveness*

No change in *pragmatic appropriateness*

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[94] (A): 3 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 3 recordings

Figure A5.2. Responsiveness in ABAB design: Child A2[95]
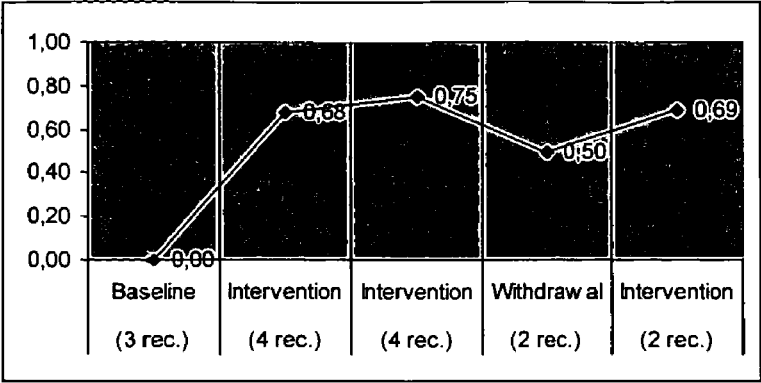
Figure A4.2. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
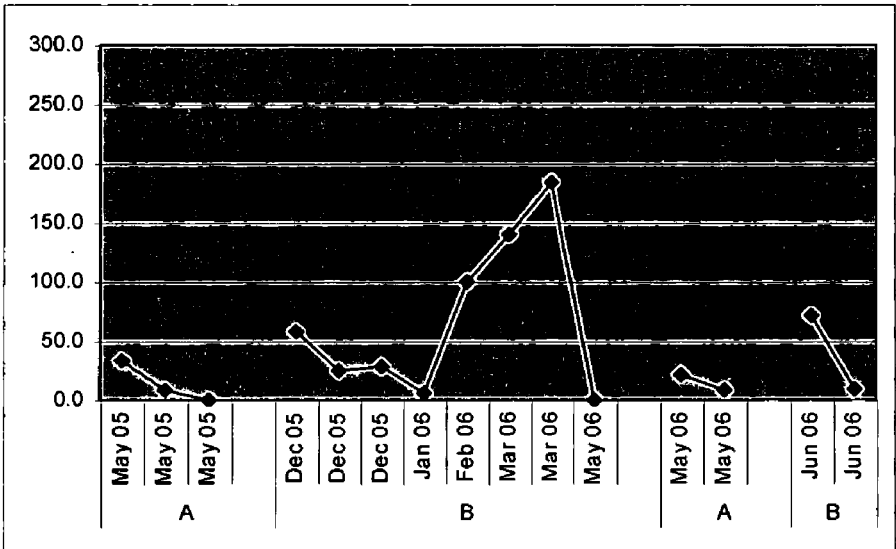
Findings:

Probable gains in *participation*

Her *participation* increased (during most lessons) with the introduction of intervention, it decreased during the withdrawal (it decreased already during the last intervention recording) and increased with the return of intervention (it decreased during the 2nd lesson after the return of intervention). No gains in *grammatical correctness*

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[95] Clear ABAB design in *responsiveness* was found in case of two children participating in the study: this child (child A2) and another male participant: child E1 (see School 3/class E/child E1, for his *responsiveness*).

Figure A1a.2. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
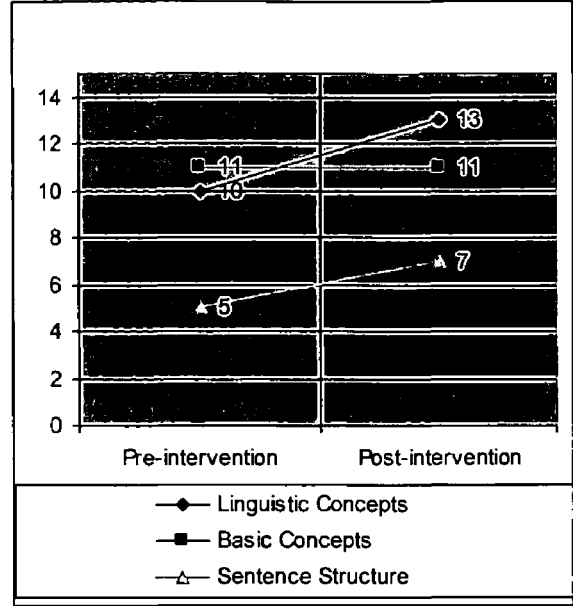
Comments:

She scored the maximum possible score on Basic Concepts both pre-intervention and post-intervention.[96]

Findings:

Clear gains in norm-referenced receptive language *total score* (+8 CI-no)

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[96] For the relevant age, the range of scores for Basic Concept subtest was 3-11.

Intervening variables:

- The majority of her utterances in the baseline were word level utterances, while there were no word level utterances in linguistic material from either of the intervention phases. This reflects to some extent the change in the lesson content.

- She produced significantly fewer utterances during the baseline than during the intervention phases.

- She did not respond to any teacher obligations in the baseline, although she was faced with fewer teacher obligations in the baseline than in any of the intervention phases.

- Baseline recordings took place at the end of the junior infant class and intervention recordings took place throughout the senior infant class. Both classes had the same teacher.

Some lessons were observed to be read out by the teacher from English language manuals presenting exemplary English language lessons.

- During the 7th recording in the intervention phase teacher posed 'bullet' questions requiring yes/no answers to the whole class (e.g., *Does the bus grow; Does a baby play*). Posing short and closed questions may impact positively on participation level (Hargreaves, 1984).

- Weather: May 06 was a very hot period.

Withdrawal of the intervention phase happened to be in May. Participation level was low also during the last recording in the intervention phase (which was recorded in May as well), just before the withdrawal phase. Baseline recordings were obtained in May 05. Although May 05 was not as hot as May 06, the time of the year could have had some impact on the scores.

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- Lesson content: 4th intervention recording

Her participation level was low during the 4th recording in the intervention (in January 06). Lower scores in participation during this lesson were noted for the whole class. During this lesson, the children described a poster and labelled furniture and kitchen and bathroom appliances (e.g., *What's an extension*). They were required to attend to small details on the poster (e.g., *pillow*, *sink*). The lesson was introduced in a whole-class format. Some children (including this child) might have had difficulties seeing the details in the poster sufficiently clearly.

Conclusion:

Gains were noted on all language dimensions, both those norm-referenced (*receptive language*) and those observed in the classroom context (*responsiveness* and *participation*). Some gains on dimensions observed in the classroom could have been attributable partly to an increase in teacher's attention and changed lesson content. Additionally, it must be recognised that the baseline phase was recorded in junior infants and the intervention phase was recorded in senior infants. Very clear ABAB design in *responsiveness* was observed, which suggests that this child could have had some undetected hearing problems and that the intervention clearly improved her ability to hear the teacher obligations. As gains were observed both in the classroom and in a norm-referenced comparison, it can be concluded that SFA supported language development for this child.

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Table A1.3. Profile: <u>Child A3</u>

Gender	Female
Age at the start of intervention	5 years
Language skills pre-intervention	Excellent (above the norms for age) receptive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone on 10 days out of 12 the researcher arrived

Figure A.3.3. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[97]
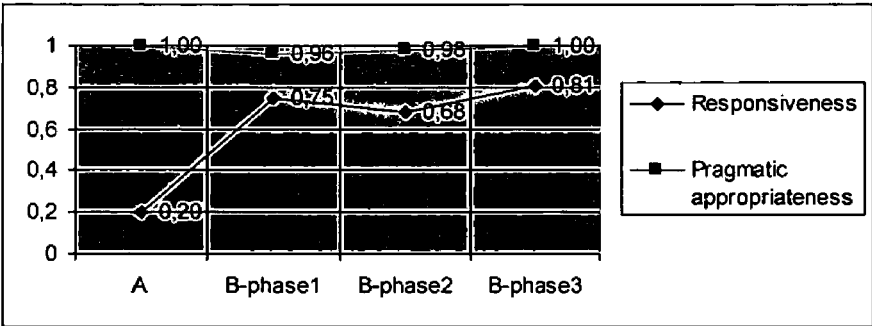
Findings:

Clear gains in *responsiveness*

No change in *pragmatic appropriateness*

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[97](A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings, (B3): 3 recordings

Figure A4.3. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
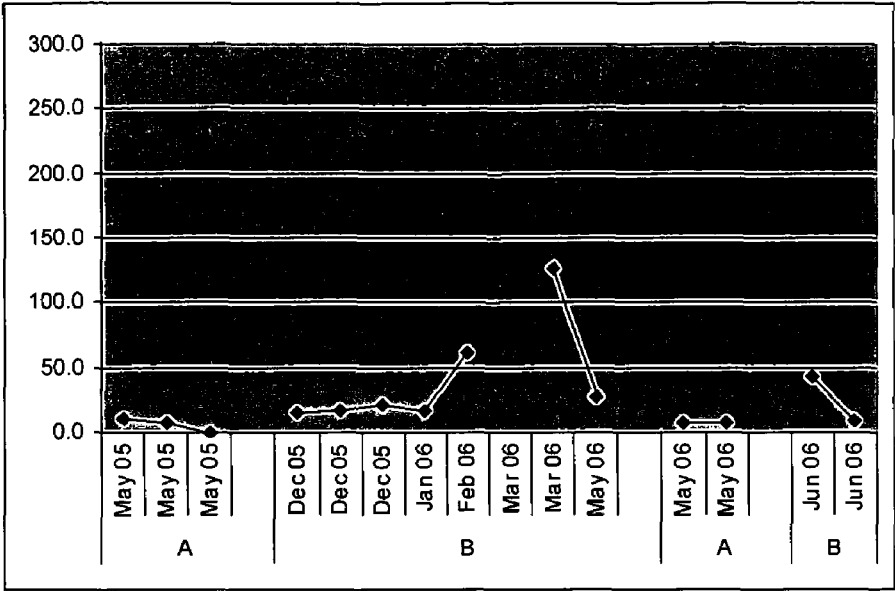
Findings:

Probable gains in *participation* (ABAB design)

Her *participation* level did not increase immediately after the introduction of intervention but only since February 06. It decreased during the withdrawal of intervention (it decreased already during the last intervention recording) and increased with the return of intervention (it decreased during the 2nd lesson after the return of intervention).

Clear gains in *loquacity*

Not immediate gains in *syntactic complexity*

No change in *grammatical correctness*

Figure A1a.3. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
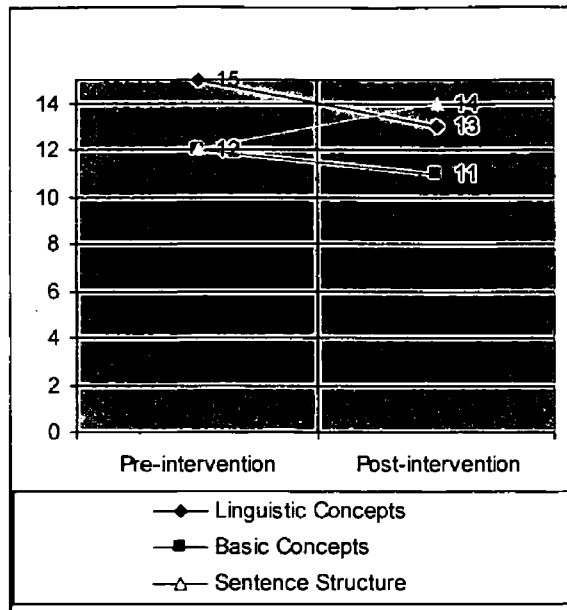
Comments:

The score of 12 at the pre-intervention assessment and the score of 11 at the post-intervention assessment on the Basic Concepts subtest were the maximum possible scores for relevant age. The score of 15 at the pre-intervention assessment and the score of 13 at the post-intervention assessment on the Linguistic Concepts subtest were the maximum possible scores for relevant age. The score of 14 at the post-intervention assessment on the Sentence Structure was also the maximum possible.

Findings:

Probable gains in norm-referenced receptive language *total score* (+3 CI-o)

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Intervening variables:

- The linguistic material obtained in the baseline was much poorer which was probably attributable to the fact that she almost did not volunteer to participate and did not receive many obligations from her teacher in the baseline.

- A significant proportion of her utterances recorded during the baseline were word level utterances while there were almost no word level utterances after the introduction of intervention.

This was also the case for three other study participants from this class and it reflects the lesson content to some extent. Phonics lessons were introduced in the baseline, while they were absent in the intervention phases.

- She received fewer teacher obligations in the baseline than she did in either of the intervention phases. Yet, her *responsiveness* was very low prior to intervention and it improved significantly and immediately with the introduction of intervention.

- Lesson content: Her *responsiveness* decreased slightly in the 2nd intervention phase (so did the *responsiveness* of another child from this class: child A1).

See 'Intervening variables' in a case study of child A1 from this class for elaboration.

- The baseline lessons were recorded in junior infants, while the intervention lessons were recorded in senior infants.

See 'Intervening variables' in a case study of child A1 from this class for elaboration.

- During the 7th recording in the intervention phase teacher posed 'bullet' questions requiring yes/no answers to the whole class.

See 'Intervening variables' in a case study of child A1 from this class for elaboration.

- Time/weather: May 06 was very hot

See 'Intervening variables' in a case study of child A1 from this class for elaboration.

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Conclusion:

Gains were noted on *participation, loquacity* and *responsiveness*. This child gained also slightly on the norm-referenced Sentence Structure subtest. Her receptive language pre-intervention was already well above the norms for her age and almost in the highest possible range. The observation of gains needs to be qualified by the recognition of significant differences between pre- and post-intervention phases, in terms of teacher's attention, teacher's stimuli and lessons' content. It can be concluded that SFA supported the language gains of this child as gains were observed on almost all studied dimensions and the majority of them were observable immediately after SFA installation.

Table A1.4. Profile: <u>Child A4</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	5 years 3 months
Language skills pre-intervention	Moderate receptive language disorder
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone on 10 days out of 12 the researcher arrived.

Figure A3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[98]
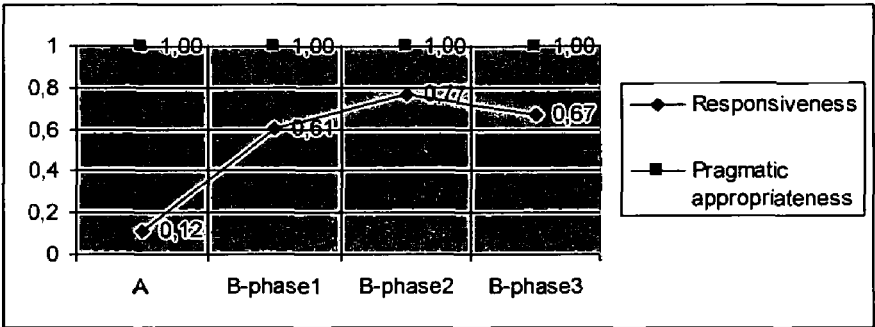
Findings:

Clear gains in *responsiveness*

No gains in *pragmatic appropriateness*

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[98] (A): 3 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 3 recordings

Figure A4.4. Participation pre-intervention (A) and after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
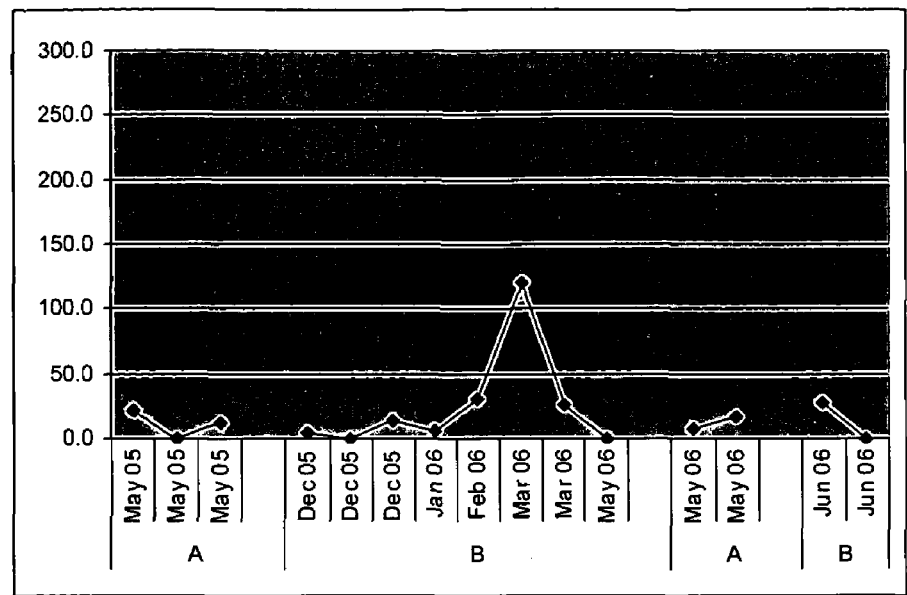
Findings:

No gains in *participation*

His *participation* was high only during one lesson: 6th intervention recording.

Clear gains in *grammatical correctness*

Figure A1a.4. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
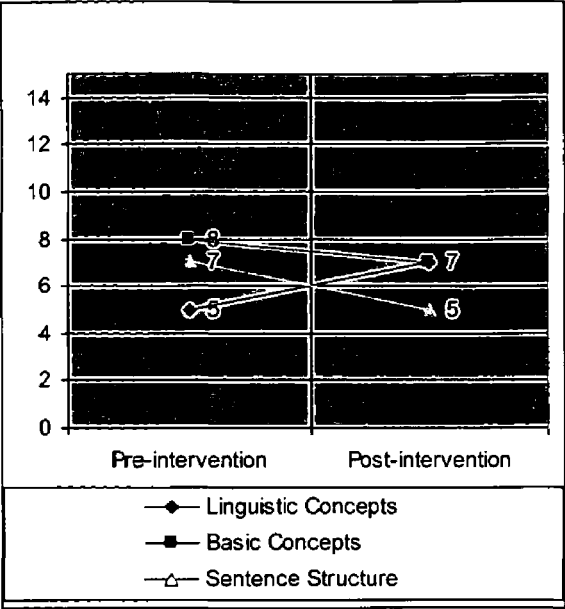
Findings:

No gains in norm-referenced receptive language *total score* (-3 CI-o)

247

Intervening variables:

- The number of utterances produced by him was much greater after the introduction of intervention than in the baseline: He received more teacher obligations after the introduction was introduced than in the baseline.

- Language sample characteristics differed significantly in the baseline and intervention phases.

As much as 27% of all of his utterances in the baseline were word level utterances, only an insignificant proportion of his utterances after the introduction of intervention were of word level, meaning that they were mostly phrase and sentence level utterances.

- Baseline lessons were recorded in junior infants and lessons in the intervention phase were recorded in senior infants. Both classes had the same teacher.

- Lesson content: During the 6th intervention recording children described a poster and talked about different jobs. He was very eager to contribute during that lesson and volunteered repeatedly to talk about his family and in particular his uncle who worked as a bus driver.

- During the 7th recording in the intervention phase teacher posed 'bullet' questions requiring yes/no answers to the whole class (e.g., *Does the bus grow; Does a baby play*).

- Time/weather: May 06 was very hot.

See 'Intervening variables' in a case study of child A1 from this class for elaboration.

Conclusion:

Clear gains were observed in *responsiveness* and *grammatical correctness*. There were large differences in the richness and characteristics of the language samples between the baseline phase and the intervention phases (partly attributable to changes in the lesson content and the teacher stimulus). While there were many intervening variables present, it can be concluded that SFA supported the responsiveness of this child in the classroom as the observed gains in responsiveness were significant and observable immediately after the SFA installation.

Table A1.5. Profile: Child A5

Gender	Male
Status	International student Attention difficulties
Age at the start of intervention	4 years 7 months
Language skills pre-intervention	Moderate receptive language disorder
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	16 months
Teacher's use of microphone	Teacher wore the microphone on 10 days out of 12 the researcher arrived.

Figure A3.5. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[99]
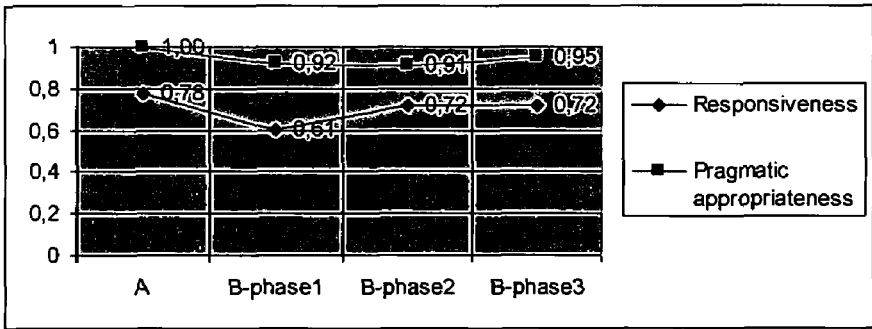
Findings:

No gains in *responsiveness*

Decrease in *pragmatic appropriateness*

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[99] (A): 3 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 3 recordings

Figure A4.5. Participation pre-intervention (A) and after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
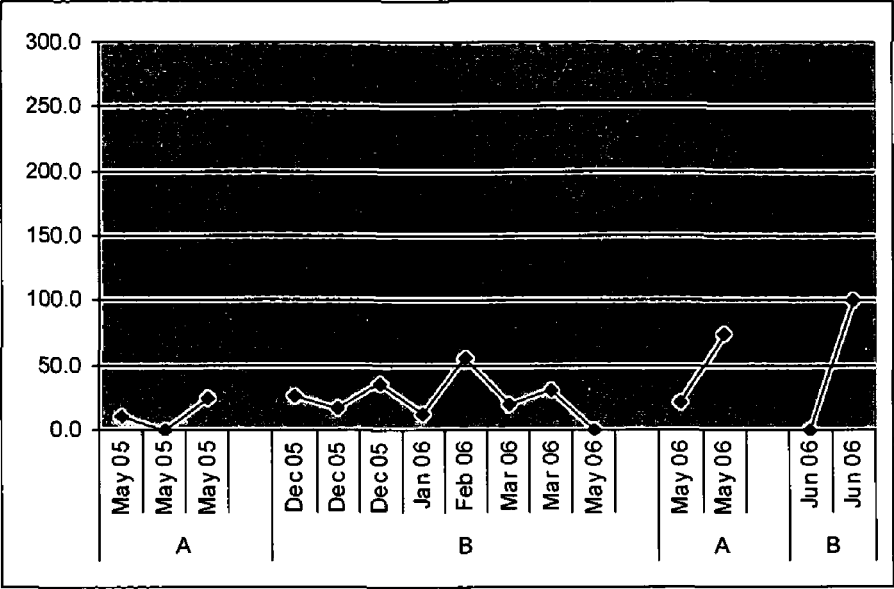
Findings:

No gains in *participation*/No clear pattern

Gains in the 3rd intervention phase in *loquacity* and *syntactic complexity*

Decrease in *grammatical correctness*

Figure A1a.5. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
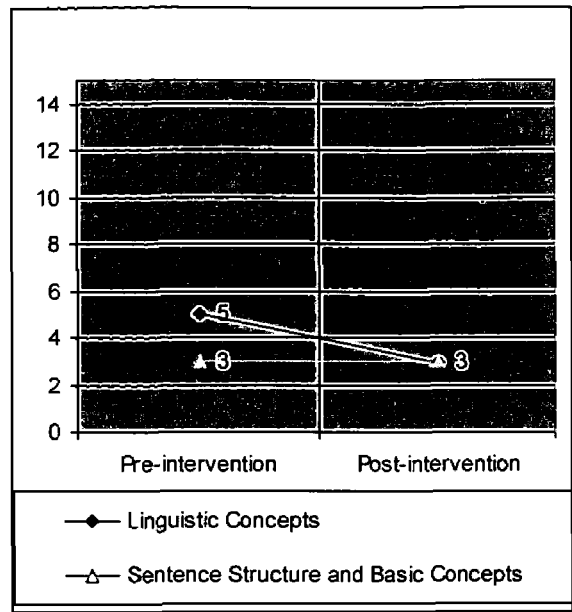
Findings:

No change in norm-referenced receptive language *total score*

252

Intervening variables:

- The number of utterances produced by him was much greater after the introduction of intervention than in the baseline.

- He received more teacher obligations in the intervention phases than in the baseline.

Additionally, when comparing the number of teacher obligations towards him and the number of teacher elicitations towards the whole class, it can be seen that the teacher directed increased attention towards him in all intervention phases (but not in the baseline).

- The baseline lessons were recorded in junior infants while the lessons in the intervention phase were recorded in senior infants. Both classes had the same teacher.

See 'Intervening variables' in a case study of child A1 from this class for elaboration.

- Weather: May 06 was a very hot period.

See 'Intervening variables' in a case study of child A1 for elaboration.

- This child was a speaker of non-standard English (African English).

Conclusion:

No immediate gains were noted on any language dimension. He began producing longer and more complex utterances only in the last phase of the intervention. His *responsiveness* post-intervention remained low and so did the score on a norm-referenced language. SFA was not observed to support the language development of this child.

School 3: DEIS Band 1 school

Class E, junior infants

Table E.1. Profile: Class E

Geographical area	Ballyfermot
Age of the class	Junior infants
Start of the intervention	SFA installed at the start of the school year (Nov)
Group/Class size (averaged from all recordings)	15 ('small')
Classroom size (inter-observer agreement)	Small room
Teacher's use of SFA	Teacher wore the microphone every day the researcher arrived

Narrative for the class

The teacher of class E was recorded to display a majority of the observed elements of good quality language teaching during a majority of lessons, including posing open-ended, cognitively challenging questions and extending on children's responses. The children in this class were given a choice of books to read and children were actively encouraged to participate in discussions that preceded and followed book reading activities. The children were frequently allowed to choose the subject of their contributions (*Who would like to say something?*). A variety of teaching methodologies were observed in each recorded lesson, including story time, topic discussion and picture description, with elements of phonics instruction incorporated into these activities.

Class summary

A majority of children in this class showed clear gains in norm-referenced expressive language. Gains in the classroom context were also observed, including syntactic complexity and loquacity gains (case studies E2, E3), responsiveness gains (very clear ABAB design; see case study E1) and pragmatic appropriateness gains (case study E5).

Table E1.1 Profile: <u>Child E1</u>

Gender	Male
Status	Twin brother of another study participant: Child E5
Age at the start of intervention	4 years 10 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure E3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[100]
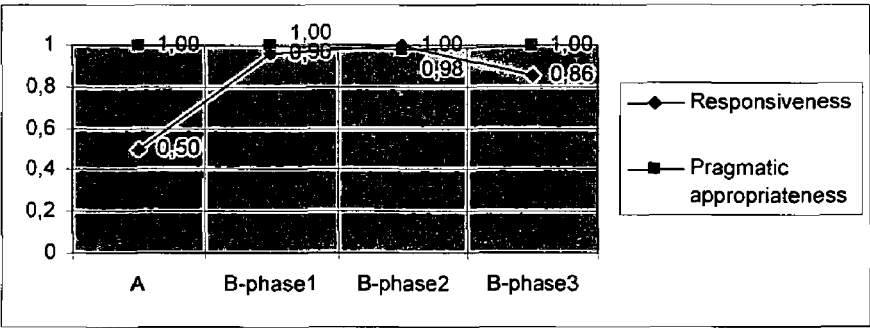
Findings:

Clear gains in *responsiveness* in ABAB pattern (see figure E5.1 below)

No gains in *pragmatic appropriateness*

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[100] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings; (B3): 3 recordings

Figure E5.1. Responsiveness in ABAB design: Child E1
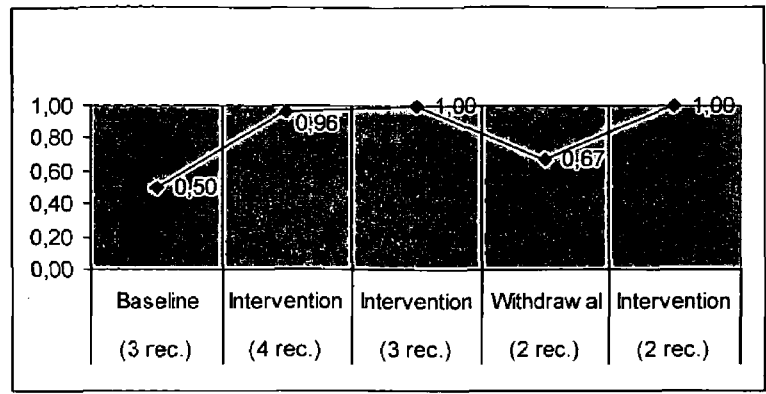
Figure E4.1. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
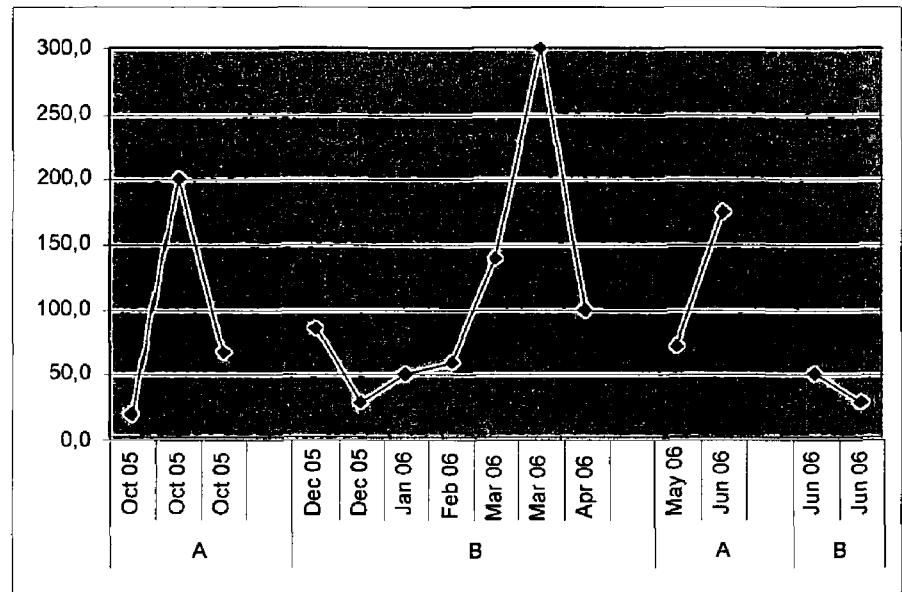
Findings:

No gains in *participation*/Not clear pattern

Probable gains in norm-referenced receptive vocabulary (+4 CI-o)

No gains in norm-referenced expressive language (-6 CI-no)

No gains in *loquacity*

No gains in *syntactic complexity*

No gains in *grammatical correctness*

256

Intervening variables:

- A norm-referenced decrease in this child's language performance was noted *only* in one sub-domain of expressive language, namely word structure, assessed by the Word Structure subtest. This decrease affected the *total* expressive language score.

This child was observed to use the grammatical markers elicited in the Word Structure subtest accurately in dynamic situations (in the classroom) but not in the static situation of standardised tests' administration (Word Structure subtest is a cloze test) (see chapter six for elaboration on standardised tests used in the study).

- He produced more clause utterances in the intervention phases than in the baseline.

Despite this variability in the number of clauses, his *loquacity* level remained stable across most study phases (with the exception of the 1st intervention phase in which his *loquacity* was lower).

- He was faced with a greater number of teacher obligations in the intervention phases than in the baseline.

- He might have experienced some hearing problems.

The teacher reported that this child had not been screened for hearing but it was '*obvious that he had hearing problems*'. He was observed tilting his head toward a person speaking in the classroom. His *responsiveness* increased to 100% in the intervention phase as evidenced in a clear ABAB design.

- The teacher introduced a variety of teaching methodologies in each lesson (e.g., story time, topic discussion, picture description). The lesson content varied throughout the study but all observations were of language lessons. Each lesson contained a combination of approaches (as above).

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The teacher also incorporated phonological instruction into some activities. She allowed the children to choose the subject of their contributions and was frequently recorded saying *Who would like to say something?* This may have skewed the scores on *participation* dimension in this class as *participation* dimension was measured against the number of teacher's elicitations.

- Lesson content: 2nd baseline recording: Phonics activities constituted a larger part of this lesson.

Children provided examples of 'm' words. He contributed a few words beginning with 'm' to one teacher's question, hence his high *participation* level.

- Time of the year

This child's *participation* decreased before Christmas and before summer holidays (he participated well in February and March).

Conclusion:

The intervention clearly aided this child's ability to hear the teacher's questions/obligations (*responsiveness* exhibits very clear ABAB design). Some gains were noted also in norm-referenced receptive vocabulary at post-intervention assessment. It can be concluded, based on the clear ABAB design in *responsiveness*, that SFA benefited this child's language performance in the classroom.

School 3, class E, junior infants

Table E1.2 Profile: <u>Child E2</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	4 years 4 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	Weekly resource hours in the school
Family situation during the study	Supportive family environment since the death of Father
Exposure to intervention	9 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure E3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[101]
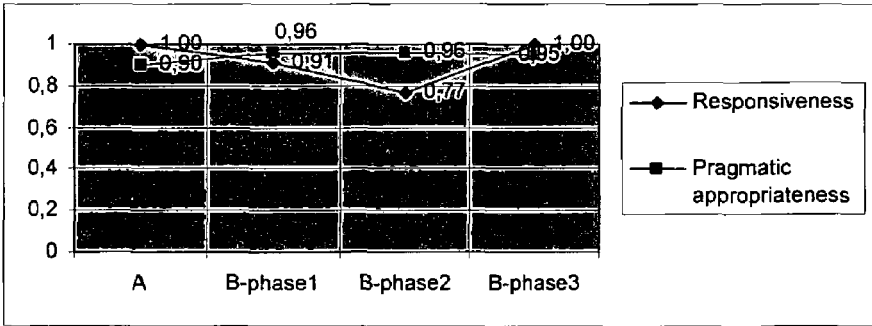
Findings:

Gains in the last two intervention phases in *pragmatic appropriateness*

No gains in *responsiveness*/Not clear pattern

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[101] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings, (B3): 3 recordings

Figure E4.2. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
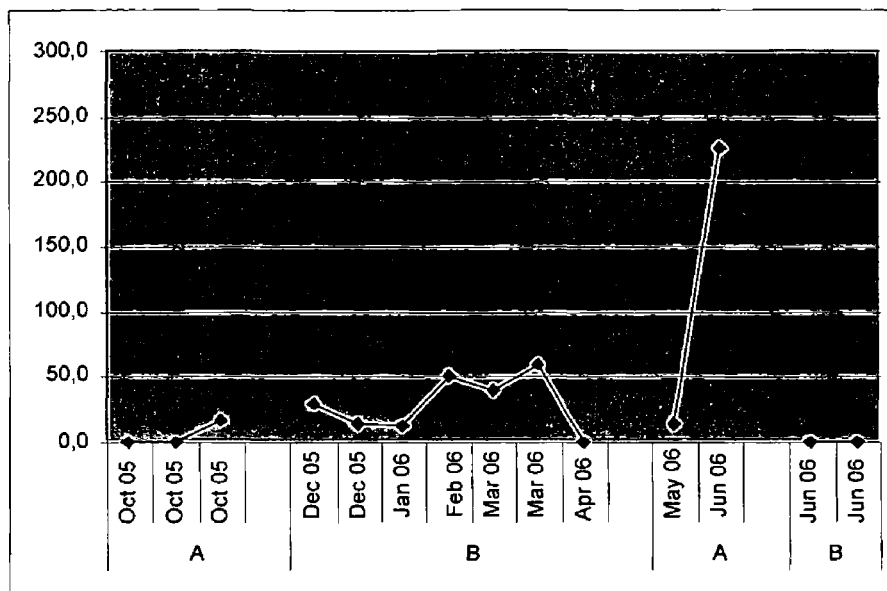
Findings:

Possible gains in *participation*

His *participation* was higher in the intervention phase than during the baseline. It exhibited unclear pattern during the withdrawal of the intervention phase and the return of the intervention phase. Some irregularities were noted also in the intervention phase.

Clear gains in norm-referenced expressive language (+7 CI-no)

Probable gains in norm-referenced receptive vocabulary (+7 CI-o)

Gains in the last two intervention phases in *loquacity* and *syntactic complexity*

Probable gains in *grammatical correctness*

Intervening variables:

- He was assessed with the CELF-P 2000 version pre-intervention and with the CELF-P2 2005 version post-intervention.

The new version of CELF-P2 was standardised in the Irish context and its administration is quicker if the child presents with no difficulties (see chapter three).

- He produced more utterances in the intervention phase than in the baseline.

The overall number of his *clausal* utterances available for analysis was, however, limited in every study phase.

- Time of the year

His *participation* level was highest in February and March (during intervention phase). A similar pattern of participation was noted also for other study participants.

- His *participation* was highest during the 2nd recording in the withdrawal of the intervention phase (first June recording). The lesson started with news time and he volunteered to contribute a few times (he talked about his dad who had passed away).

- Lesson content: 7th intervention recording: Vocabulary demands

There was a discussion about jobs in the class. Children were encouraged to label objects and people, e.g., *doctor, nurse, hospital, bandage*.

- The teacher introduced a variety of teaching methodologies in each lesson.

See 'Intervening variables' in a case study of child E1 from this class for elaboration.

Conclusion:

Gains were observed in both norm-referenced language (expressive language and receptive vocabulary) and in most language dimensions observed in the classroom context. His expressive language was reassessed post-intervention with a different version of a test which was standardised in the Irish context (see chapter three). This child received weekly resource hours in school. As his language performance in the classroom did not improve immediately after the introduction of intervention (but only from the 2nd intervention phase onwards), and given a system of other supports for this child, it cannot be concluded that these gains were clearly attributable to the intervention. However, a range of gains were noted, including clear norm-referenced gains. It is possible that certain gains were attributable to SFA.

Table E1.3 Profile: <u>Child E3</u>

Gender	Male
Age at the start of intervention	4 years 11 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	Weekly resource hours in school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure E3.3. **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[102]
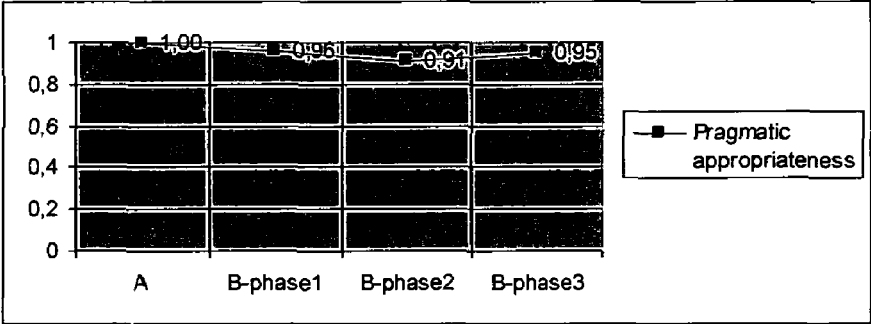
Findings:

Decrease in *pragmatic appropriateness*

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[102] (A): 3 recordings, (B1): 3 recordings, (B2): 2 recordings, (B3): 3 recordings

Figure E4.3. *Participation pre-intervention* (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
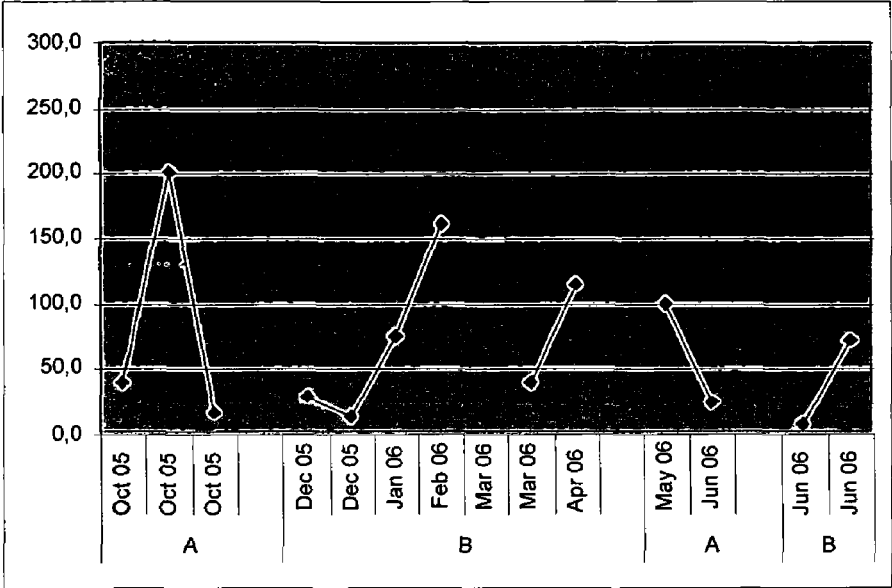
Findings:

No gains in *participation*/Not clear pattern

Clear gains in *loquacity*

Probable gains in norm-referenced expressive language (+3 CI-o)

Probable gains in *syntactic complexity*

Probable gains in *grammatical correctness*

No change in norm-referenced receptive vocabulary

Intervening variables:

- He was assessed with the CELF-P 2000 version pre-intervention and with the CELF-P2 2005 version post-intervention.

- The mean number of teacher obligations directed towards him in the 2nd intervention phase was increased compared to the other study phases.

The relationship of the number of teacher obligations directed towards him to the number of teacher questions directed towards the whole class exceeded 1.00 in the 2nd intervention phase. This indicates increased teacher attention towards this child. The lowest score in *pragmatic appropriateness*, as well as a decrease in *syntactic complexity* score were recorded in the 2nd intervention phase, when he was faced with many teacher obligations. Direct responses to questions are likely to be less pragmatically appropriate and less syntactically complex than volunteered contributions.

- The teacher introduced a variety of teaching methodologies in each lesson.

See 'Intervening variables' in a case study of child E1 from this class for elaboration.

- Lesson content: 7th intervention recording: Familiar topic and familiar vocabulary

There was a discussion about jobs in the class. He volunteered to label the objects and people related to the health topic, e.g., *doctor, nurse, hospital, bandage*. He gave an account of his recent stay in hospital (familiar subject).

- Lesson content: 2nd baseline recording, 1st withdrawal recording and 4th intervention recording introduced phonics activities.

Instruction to provide words beginning with a particular phoneme is a 'list question' and it could invite multiple responses from some students.

- Cognitive demands of 3rd baseline lesson (e.g., *Why is a hedgehog alive; How do you know I am alive*).

- Lesson content: 2nd intervention recording: poster description activity.

He was recorded saying: *Teacher I can't see* and *Teacher I am bored.*

Conclusion:

Gains were noted in expressive language measured both in a norm-referenced comparison and through observations in the classroom context (*loquacity* and *syntactic complexity*). Post-intervention norm-referenced assessment was conducted with a different test (which was shorter and standardised in the Irish context) (see chapter three). The confidence intervals of pre- and post-intervention assessments were overlapping. Immediate gains in dimensions such as participation, responsiveness or pragmatic appropriateness were not observed, and many intervening variables were noted (including additional weekly resource hours). It thus cannot be concluded that the observed gains were attributable to the intervention.

Table E1.4. Profile: <u>Child E4</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	4 years 4 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure E3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[103]
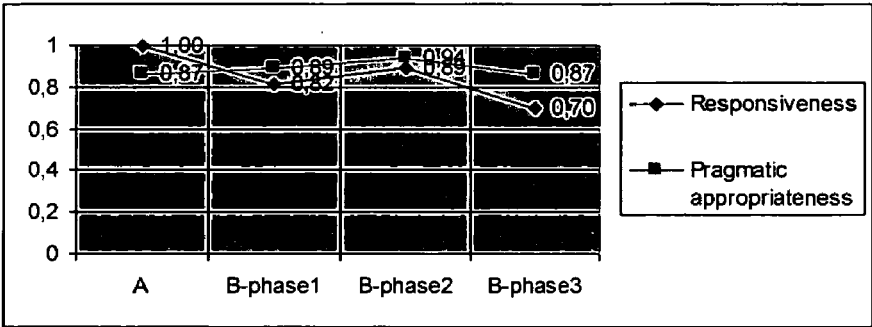
Findings:

No gains in *pragmatic appropriateness*

Decrease in *responsiveness*

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[103] (A): 2 recordings, (B1): 2 recordings, (B2): 3 recordings, (B3): 3 recordings

Figure E4.4. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
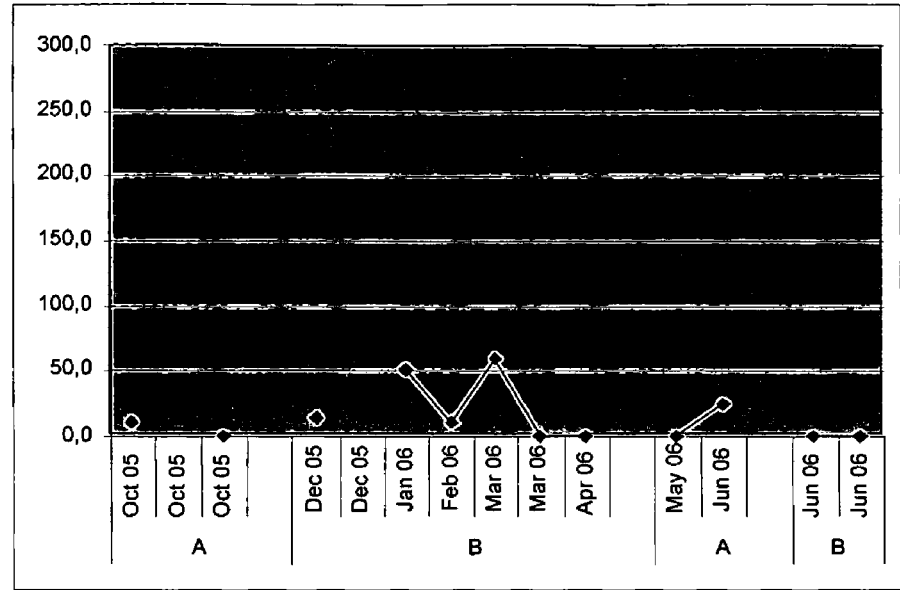
Findings:

Some small gains in *participation* though no clear consistent pattern

Clear gains in norm-referenced expressive language (+19 CI-no)

No gains in norm-referenced receptive vocabulary (-4 CI-o)

No gains in *loquacity*/No clear pattern

No gains in *syntactic complexity*/No clear pattern

No gains in *grammatical correctness*

Intervening variables:

- His expressive language abilities were assessed with the CELF-P 2000 version pre-intervention and with the CELF-P2 2005 version post-intervention

The SNA was present at the baseline assessment as this child was apprehensive about leaving the classroom for the baseline assessment. He was assessed by another SLT post-intervention. Due to this change, no SNA was present at the post-intervention assessment. The new version of CELF-P2 was standardised in the Irish context and its administration is quicker if the child presents with no difficulties (see chapter three).

- He produced more utterances in the intervention phases than in the baseline.

- His speech became dysfluent at the end of the school year (with characteristics of a stammer). He was less responsive in the last phase of the study (B3), which could have been connected to this dysfluency.

- The teacher introduced a variety of methodologies in each lesson.

See 'Intervening variables' in a case study of child E1 from this class for elaboration.

Conclusion:

Large gains were noted on the norm-referenced expressive language total score. The post-intervention standardised assessment was conducted with a different version of a test that was standardised in the Irish context (see chapter three). It is also possible that the baseline results might not have shown this child's true language ability, as he was apprehensive about leaving the classroom for testing (the SNA was requested to accompany him). Thus, it cannot be concluded that the expressive language gains were attributable to the intervention. In the absence of gains on other language dimensions, it cannot be concluded that SFA supported the language performance of this child.

School 3, class E, junior infants

Table E1.5 Profile: Child E5

Gender	Female
Status	Twin sister of another study participant – child E1
Age at the start of intervention	4 years 10 months
Language skills pre-intervention	Moderate expressive language disorder Within norms for age receptive vocabulary
Auxiliary services during the study	Special Needs Assistant assigned from Nov05 (SFA was installed at the start of Nov05) Psychological assessment at the hospital in June06 (at the end of the study)
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure E3.5. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[104]
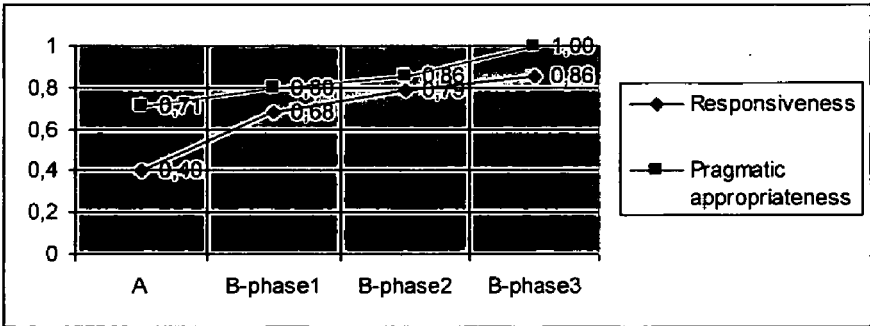
Findings:

Clear gains in *responsiveness*

Clear gains in *pragmatic appropriateness*

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[104] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings, (B3): 3 recording

Figure E4.5. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)
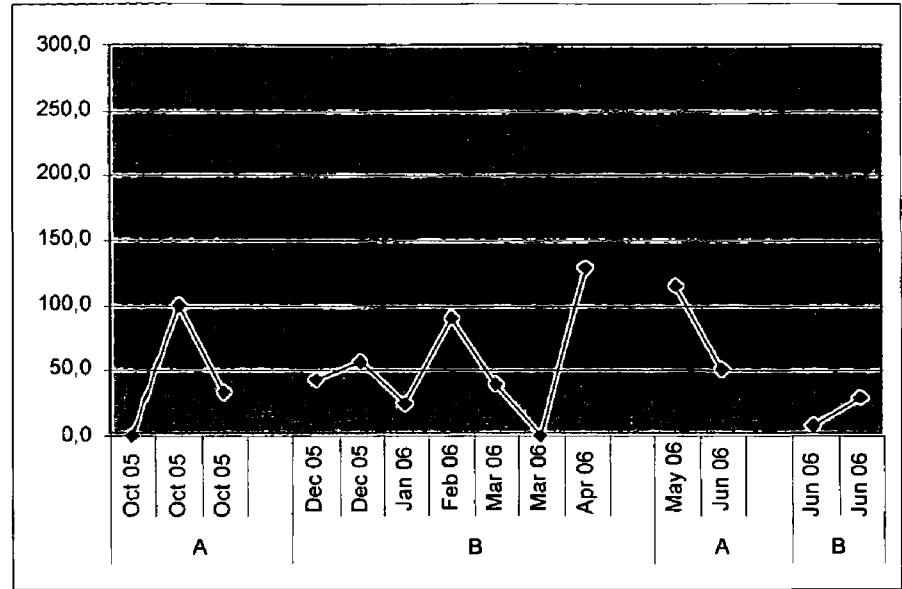
Findings:

No gains in *participation*/Not clear pattern

No gains in norm-referenced expressive language (-6 CI-no)

No change in norm-referenced receptive vocabulary

Decrease in *grammatical correctness*

Intervening variables:

- She produced more utterances in the intervention phase than in the baseline.

- Teacher directed more obligations towards her after the introduction of intervention than in the baseline: she received increased teacher attention particularly in the 2nd and the 3rd intervention phases (B2 and B3). Her *responsiveness* increased in the intervention phase despite the increased number of teacher obligations she was faced with.

- The teacher introduced a variety of methodologies in each lesson.

See 'Intervening variables' in a case study of child E1 from this class for elaboration.

- Lesson content: 2nd baseline recording, 1st withdrawal recording and 4th intervention recording introduced phonics activities.

Instruction to provide words beginning with a particular phoneme is a 'list question' and it could invite many responses from some students.

Conclusion:

She began responding to more teacher obligations and providing more *pragmatically appropriate* and *adequate responses* after the introduction of the intervention. It may be thus concluded that she could hear the teacher better (which aided her comprehension) and that gains on these two dimensions were supported by SFA. This conclusion needs to be qualified by the following observation. First, teacher paid more attention to her in the intervention phase and, secondly, an SNA was assigned to this child at the end of the baseline phase of the study.

School 4: DEIS Band 1 school

Class H, junior infants

Table H.1. Profile: Class H

Geographical area	Inner city
Age of the class	Junior infants
Start of the intervention	SFA installed at the start of school year (Nov)
Group/Class size (averaged from all recordings)	12 (<15, 'small')
Classroom size (inter-observer agreement)	Small room
Teacher's use of SFA	Teacher wore the microphone every time the researcher arrived

Narrative for the class

The teacher of class H was observed to shift power relations towards the children and to encourage their spontaneous contributions (often during circle time). He made little use of language stimulation techniques and did not consistently create a context for complex elaborated language use. This was reflected in linguistically poorer language samples recorded in this class. Dialogic reading situations were recorded in this class on a few occasions. There were also a few decontextualised phonics and phonological instruction activities (see chapter six for elaboration) and elements of mathematics instruction videotaped in this class.

Class summary

There were varying outcomes for children in this class, however, all children assessed on norm-referenced receptive language and receptive vocabulary made some gains in these dimensions (case studies H1, H2, H3). Gains in loquacity and syntactic complexity were noted for two children (case studies H2, H4). Clear gains in responsiveness for child H3, for whom English was an additional language, were recorded.

Table H1.1. Profile: <u>Child H1</u>

Gender	Male
Age at the start of intervention	4 years 7 months
Language skills pre-intervention	Moderate receptive language impairment Mild expressive language delay
Auxiliary services during the study ·	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure H3.1. <u>**Responsiveness**</u> and <u>**Pragmatic appropriateness**</u> pre-intervention (A) and after the introduction of intervention (B)[105]
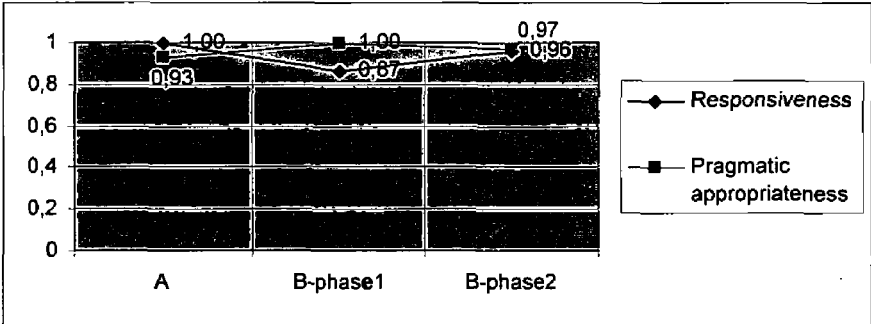
Findings:

Probable gains in *pragmatic appropriateness*

No gains in *responsiveness*/Not clear pattern

Figure H4.1. Participation pre-intervention (A) and after the introduction of intervention
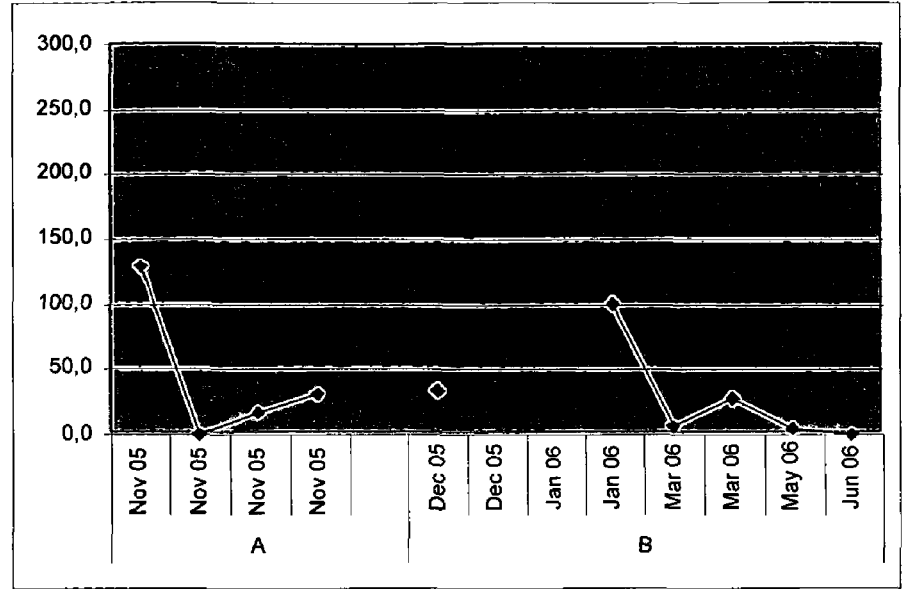
Findings:

No gains in *participation*

Clear gains in norm-referenced expressive language (+14 CI-no)

Clear gains in *grammatical correctness*

Probable gains in norm-referenced receptive vocabulary (+6 CI-o)

No gains in *loquacity*/Not clear pattern

No gains in *syntactic complexity*/Not clear pattern

Figure H1a.1. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
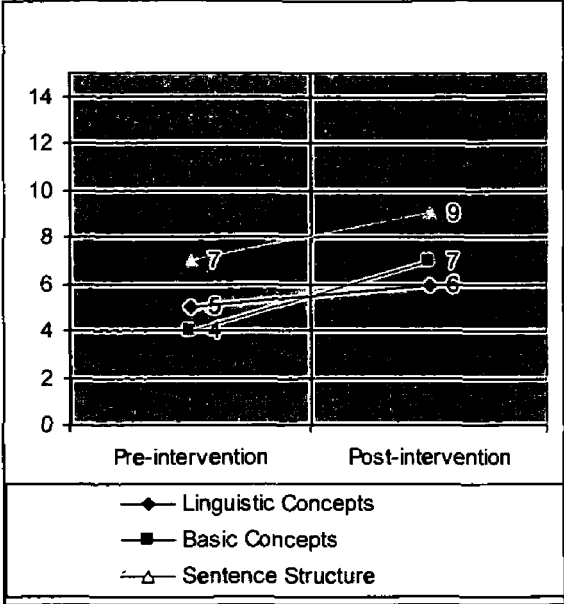
Findings:

Clear gains in norm-referenced receptive language *total score* (+3 CO-no)

Intervening variables:

- This child's speech was much more intelligible at the end of the intervention phase, compared to the baseline.

He did not reduce clusters of consonants and final consonants (e.g., final –s) at post-intervention standardised assessment as he did at pre-intervention assessment. Phonological processes in his speech during the baseline assessment could have impacted on the performance in the expressive language test. This might have been particularly the case with subtests that required attention to small word units (morphemes), such as: Word Structure and Recalling Sentences in Context subtests. At the post-intervention assessment he made the greatest progress on those subtests. As speech was not a direct focus of this study, the effect of intervention on his speech was not analysed.

- Lessons differed in content.

Teacher introduced maths lessons as well as English lessons, the latter including story time and news time as well as drama and phonics lessons.

- He was observed to participate very willingly during news time.

News time was introduced three times: once in the baseline and twice in the 1st intervention phase. (He was present for news time once in the baseline and once in the 1st intervention phase.) News time differs significantly from other classroom discourse as the subject matter is not restricted in any way. Self-initiated utterances are likely to be longer (which impacts on loquacity score) and they could also be more syntactically complex (news time generates long, narrative-style language samples). He was absent on two occasions during the 1st intervention phase. Thus, there were only two recordings in the 1st intervention phase from which the scores on individual dimensions were averaged (four recordings constituted the 1st intervention phase for other children

in this class). News time occurred during one of those recordings. Hence, a high score on loquacity and syntactic complexity in the 1st intervention phase.

- Lesson content: 4th intervention recording was devoted almost entirely to phonics instruction (letter-sound correspondences, e.g. *Can you tell me what sound that makes*).

He was observed to participate in this activity very willingly.

Conclusions:

Gains in norm-referenced receptive language total score (clear gain in all sub-domains of receptive language) and norm-referenced receptive vocabulary were observed. Gains in *grammatical correctness* and in the norm-referenced expressive language total score might have been attributable to improved speech intelligibility. It must, however, be recognised that the intervention might have supported this improvement (this child received no SLT services during the study). In the absence of other gains in class-derived language dimensions, it cannot be concluded that it was SFA that supported the gains. It is possible, however, that the intervention might have supported improved speech perception and further speech intelligibility for this child.

Table H1.2. Profile: <u>Child H2</u>

Gender	Male
Age at the start of intervention	5 years 3 months
Language skills pre-intervention	Within norms for age receptive language Exceptional expressive language (above the norms for age)
Auxiliary services during the study	No
Family ecology during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure H3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[106]
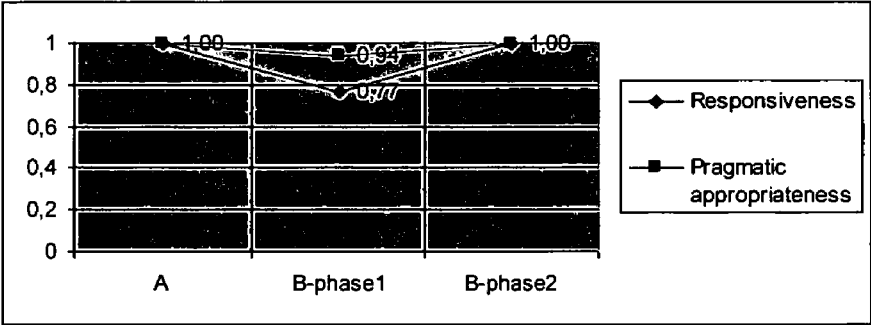
Findings:

No gains in *responsiveness*/Not clear pattern

No gains in *pragmatic appropriateness*/Not clear pattern

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[106] (A): 4 recordings, (B1): 4 recordings, (B2): 4 recordings

Figure H4.2. Participation pre-intervention (A) and after the introduction of intervention (B)
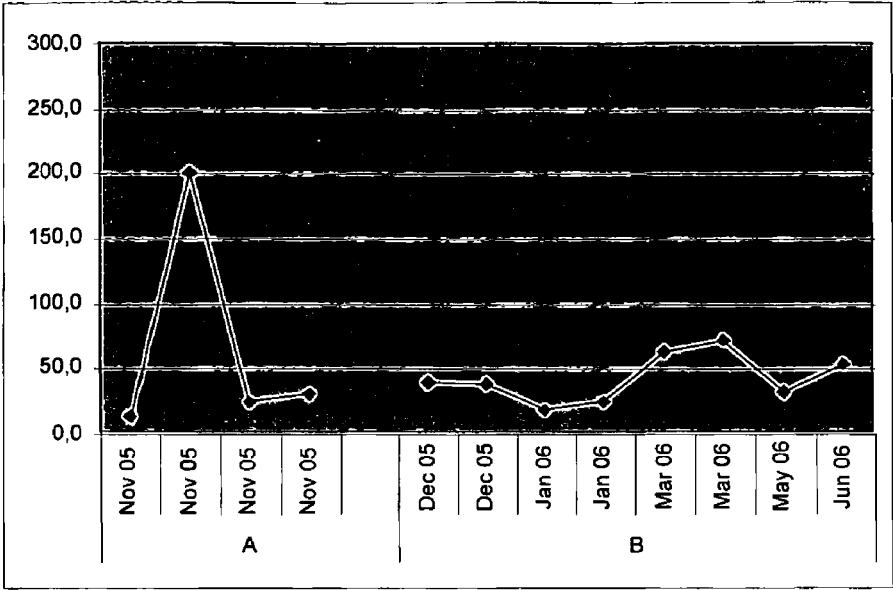
Findings:

No gains in *participation*

Clear gains in *loquacity*

Probable gains in *syntactic complexity*

Probable gains in norm-referenced receptive vocabulary (+6 CI-o)

No gains in norm-referenced expressive language (-10 CI-no)

Figure H1a.2. CELF-P **Receptive language** subtest results pre-intervention and post-intervention
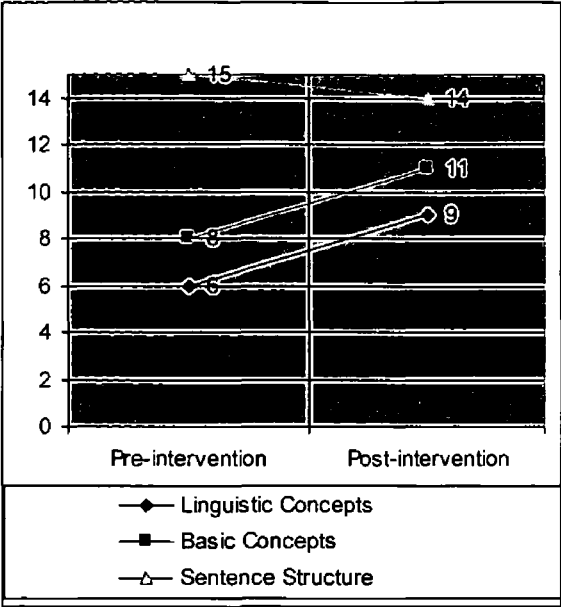
Findings:

No change in norm-referenced receptive language *total* score. However, gains were observed on two individual subtests of this test, namely Basic Concepts and Linguistic Concepts.

Intervening variables:

- Lesson content: This child produced syntactically complex sentences only during two recorded lessons: 3rd intervention recording (in 1st intervention phase) and 5th intervention recording (in 2nd intervention phase). Both recordings were taken during story time as children were encouraged to predict future events in the story.

This cognitive process might have invited syntactically complex structures with, for example, mental verbs: 'think' and 'know' (e.g., *I think that he is going to eat that*). This child seemed to be unmotivated/disengaged during some other lessons (e.g., during news time or labelling activities). It is worth remembering that his expressive language abilities were exceptional (above the norm) prior to amplification (as measured by standardised tests).

- He seemed to be unmotivated/disengaged during some lessons (e.g. during news time).

For instance, he failed to recall the other students' news during two lessons in the 1st intervention phase, which started with news time (e.g., *What did Sylvia's mum buy her; Do you know what Sylvia was watching on television*).

- Lesson content: 3rd intervention recording and 4th intervention recording were devoted almost entirely to phonics instruction (letter-sound correspondences, e.g., *Can you tell me what sound that makes*). He did not participate willingly in phonics lessons.

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Conclusion:

Gains were noted in norm-referenced receptive vocabulary and in two subdomains of norm-referenced receptive language (Basic Concepts and Linguistic Concepts). Furthermore, this child contributed longer and more syntactically complex utterances in the intervention phase compared to the baseline. It can thus be concluded that SFA supported the language development of this child.

Table H1.43. Profile: Child H3

Gender	Male
Status	International student[107]
Age at the start of intervention	5 years 3 months
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure H3.3. **Responsiveness** pre-intervention (A) and after the introduction of intervention[108]
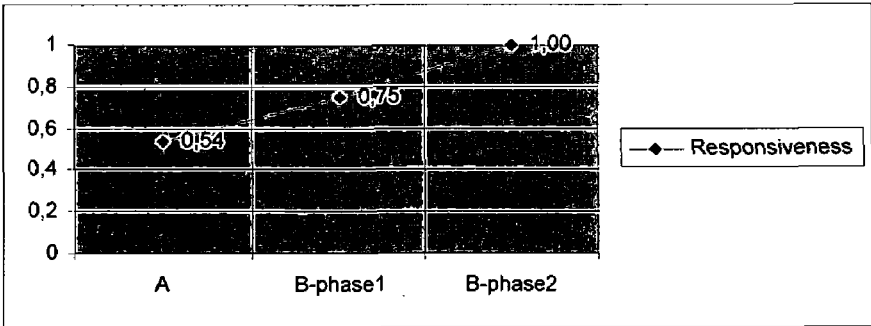
Findings:

Clear gains in *responsiveness*

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[107] This child's level of English pre-intervention was insufficient to perform a comprehensive language assessment. Many of his utterances were unintelligible and he spoke in his first language at times. Thus, standardised tests were *not* administered to him and his language was *not* analysed on *loquacity, syntactic complexity, grammatical correctness* and *pragmatic appropriateness* dimensions. His baseline language profile was based on only two dimensions: *responsiveness* and *participation*.

[108] (A): 4 recordings, (B1): 4 recordings, (B2): 3 recordings

Figure H4.3. Participation pre-intervention (A) and after the introduction of intervention (B)
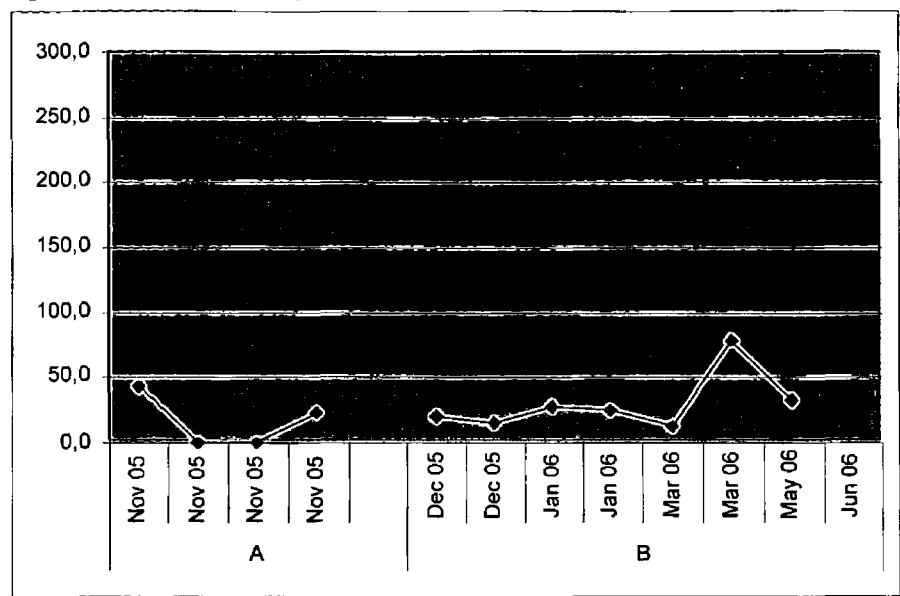
Findings:

No gains in *participation*

Intervening variables:

- Teacher directed increased attention towards him in the baseline (i.e. the number of teacher obligations directed towards this child was greater than the number of teacher questions directed towards the whole class; see chapter three).

- Lessons differed in content.

See 'Intervening variables' in a case study of child H1 from this class for elaboration.

Conclusion:

Clear large gains were noted in *responsiveness*. The baseline was recorded during this child's first months in an English-speaking classroom (the start of junior infants). His command of the English language was very limited in the baseline. It could be hypothesised that some gains would have been made without the intervention. However, it is likely that it was partly the intervention that helped this child to hear and understand the teacher better.

Table H1.4. Profile: Child H4

Gender	Male
Age at the start of intervention	4 years 9 months
Language skills pre-intervention	Within norms for age receptive language Within norms for age expressive language
Auxiliary services during the study	No
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure H3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[109]
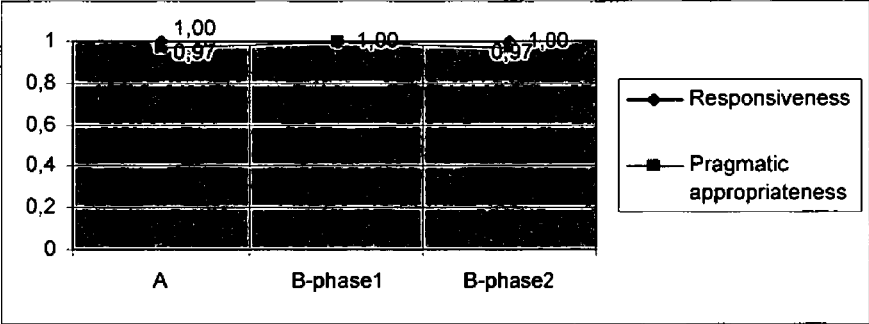
Findings:

No change in *responsiveness*

No gains in *pragmatic appropriateness*

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[109] (A): 4 recordings, (B1): 4 recordings, (B2): 4 recordings

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Figure H4.4. Participation pre-intervention (A) and after the introduction of intervention (B)
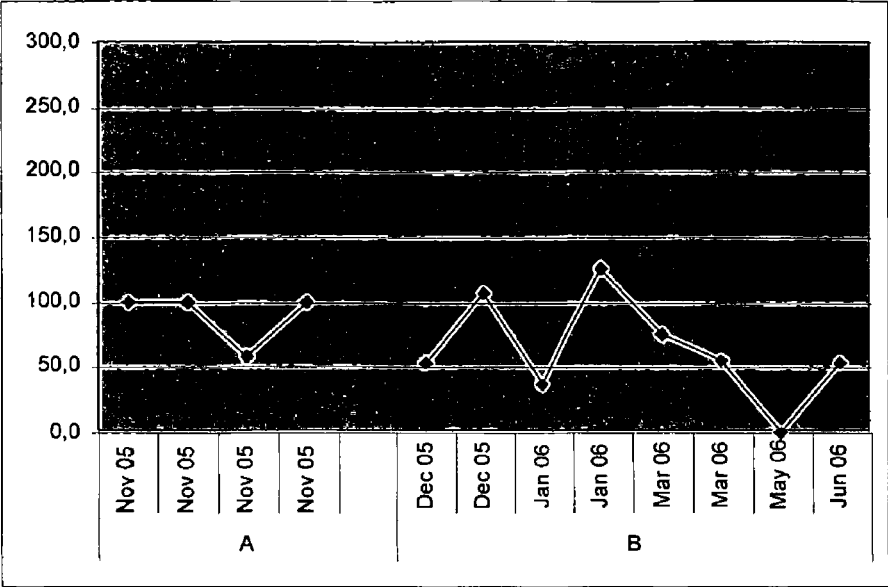
Findings:

No gains in *participation*/No clear pattern

Probable gains in norm-referenced receptive vocabulary (+18 CI-o)

Probable gains in *loquacity*

Gains in the 2nd intervention phase in *syntactic complexity*

No gains in norm-referenced expressive language (-7 CI-no)

Decrease in *grammatical correctness*

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Figure H1a.4. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
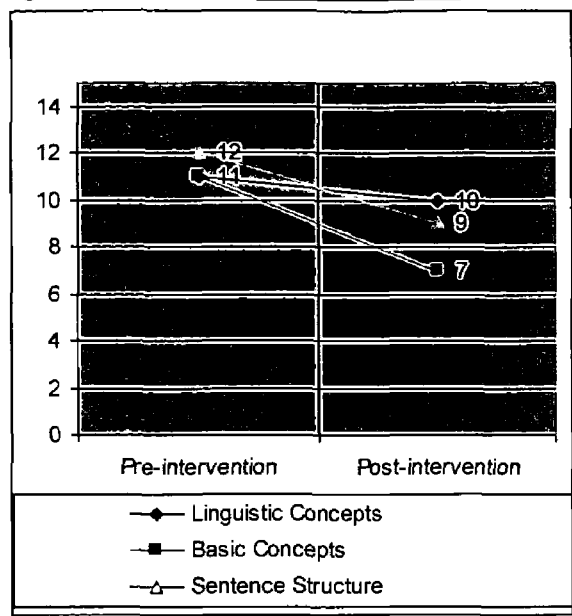
Findings:

No gains in norm-referenced receptive language *total score* (-17 CI-no)

Intervening variables:

- Lessons differed in content.

See 'Intervening variables' in a case study of child H1 from this class for elaboration.

- He was observed to be withdrawn in the classroom during some lessons. The school was not aware of any personal problems that might have impacted on his level of engagement in the classroom.

Conclusion:

Large gains were noted in norm-referenced receptive vocabulary and some not immediate gains were noted in *syntactic complexity* and *loquacity*. Largely varying lesson content must be interpreted as an intervening variable (this variability is clearly visible in a fluctuating pattern of *participation*). Furthermore, many language dimensions were 'of no concern' to this child, i.e. he showed good baseline abilities in *responsiveness* and *pragmatic appropriateness* as well as in norm-referenced expressive and receptive language. This child was observed to be withdrawn at times. His language profile may thus seem 'uneven' due to his fluctuating level of engagement which could, perhaps, have been due to some personal problems that were not known to the school. As no immediate and consistent gains were noted in his language performance in the classroom, it cannot be concluded that the intervention supported language development for this child.

School 4: class D, senior infants

Table D.1. Profile: Class D

Geographical area	Inner city
Age of the class	Senior infants
Start of the intervention	SFA installed at the start of school year (Nov)
Group/Class size (averaged from all recordings)	11 (<15, 'small')
Classroom size (inter-observer agreement)	Large room
Teacher's use of SFA	Teacher wore the microphone every time the researcher arrived

Narrative for the class

The teacher of class D was observed to consistently display all observed elements of good quality of language teaching in all recorded lessons. She shifted power relations in favor of the children and encouraged spontaneous contributions. The discourse model in this class resembled a model of 'guided participation' (Rogoff, 1993), with the teacher making a good use of language stimulation techniques including modeling, expanding, extending, recasting and evaluating. All observed lessons were recorded in the context of a story reading. This class was observed over more than one academic year (the class was taught in the same room and by the same teacher in first class).

Class summary

Gains in a majority of studied dimensions were observed for a majority of children in this class. These included both norm-referenced receptive language gains and gains in participation, responsiveness, pragmatic appropriateness, loquacity and syntactic complexity.

Table D1.1. Profile: <u>Child D1</u>

Gender	Male
Status	International student
Age at the start of intervention	4 years 11 months
Language skills pre-intervention	Moderate receptive language disorder Moderate expressive language disorder
Auxiliary services during the study	Weekly Language support in school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	13 months[110]
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure D3.1. **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[111]
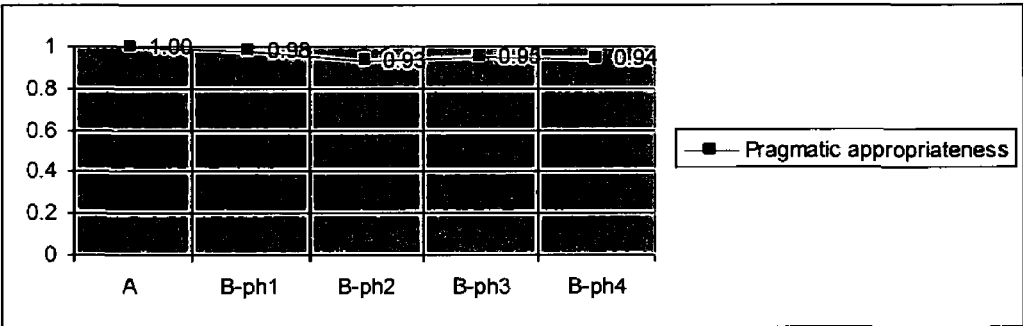
Findings:

Decrease in *pragmatic appropriateness*

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[110] The ABAB design was repeated in this class thus extending the assessment duration to 16 months. The post-intervention standardised tests administration occurred 13 months after the pre-intervention administration.

[111] (A): 3 recordings, (B1): 3 recordings, (B2): 3 recordings, (B3): 2 recordings, (B4): 2 recordings

Figure D4.1. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A), after the return of intervention (B), during the second withdrawal of intervention (A) and the second return of intervention
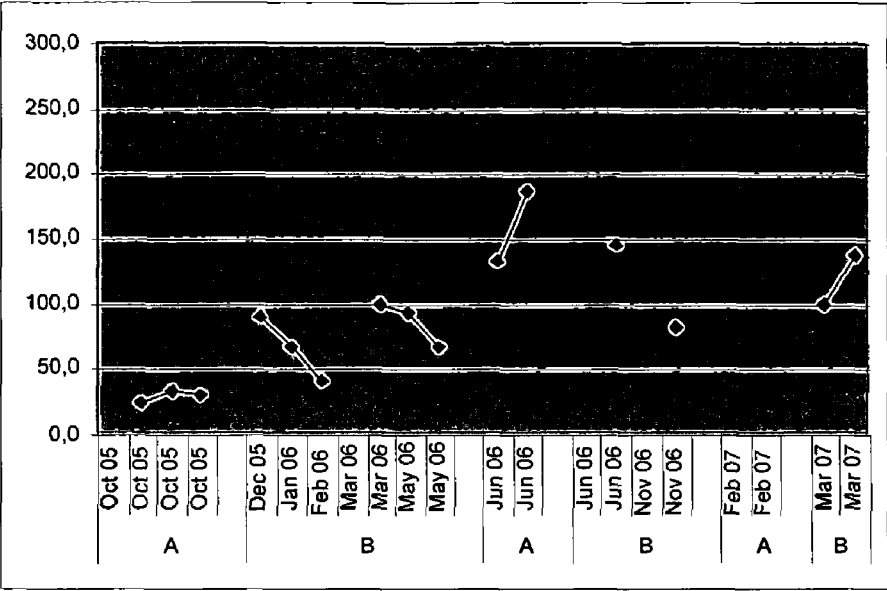
Findings:

Probable gains in *participation*

Participation clearly increased with the introduction of intervention. It did not decrease with the withdrawal of intervention. High participation level was maintained also during the withdrawal of intervention (in June06 he volunteered to respond to each teacher's question and also offered some relevant spontaneous contributions).

Gains in the last intervention phase in *loquacity* and *syntactic complexity*

No gains in norm-referenced expressive language

No gains in *grammatical correctness*

Figure D1a.1. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
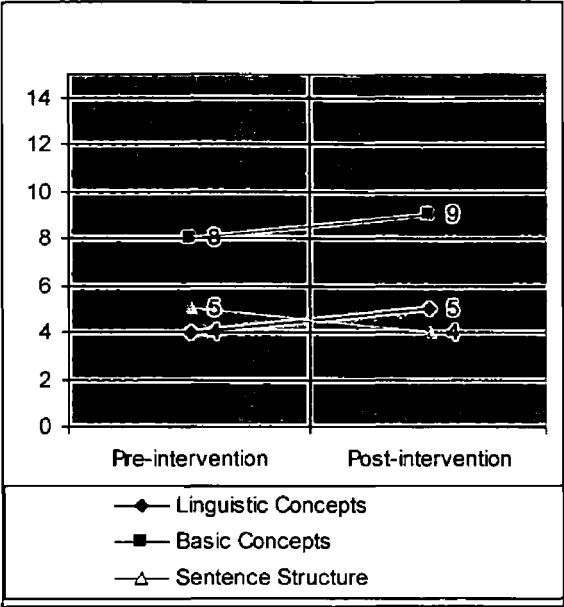
Findings:

No gains in norm-referenced receptive language *total score*

Intervening variables:

- This child produced more utterances in the intervention phase than in the baseline. There was a significant discrepancy in the wealth of linguistic material produced by him pre- and post-intervention. This was probably influenced by the fact that his *participation* level was lower in the baseline and that he received fewer teacher obligations in the baseline.

- The proportion of word level utterances varied across the study phases.

This reflected the lesson content to some extent. Teacher introduced some phonological awareness lessons in the 2nd intervention phase and thus the percentage of word level responses was higher at the end of the study.

Conclusion:

His participation increased immediately with the introduction of the intervention and he began producing longer and more complex utterances in the 2nd intervention phase. Some increase in *loquacity* and *syntactic complexity* could have been attributable to maturation as gains in these two dimensions were not immediate, as well as to weekly language support this child received in school. No language gains were observed on standardised tests (English was not the first language of this child). It can be concluded that the intervention was likely to support gains in classroom participation for this child.

School 4, class D, senior infants

Table D1.2. Profile: Child D2

Gender	Male
Status	International student
Age at the start of intervention	5 years 3 months
Language skills pre-intervention	Moderate receptive language disorder Moderate expressive language disorder
Auxiliary services during the study	Weekly Learning and Language Support lessons in the school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure D3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[112]
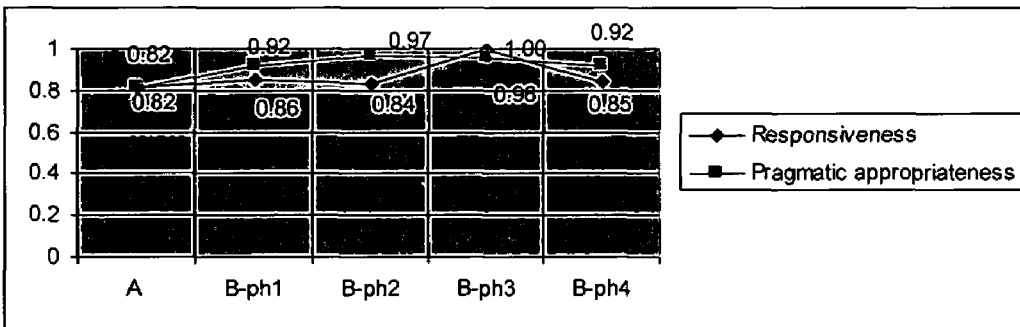
Findings:

Clear gains in *pragmatic appropriateness*

Probable gains in *responsiveness*

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[112] (A): 4 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 4 recordings, (B4): 2 recordings

Figure D4.2. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A), after the return of intervention (B), during the second withdrawal of intervention (A) and the second return of intervention
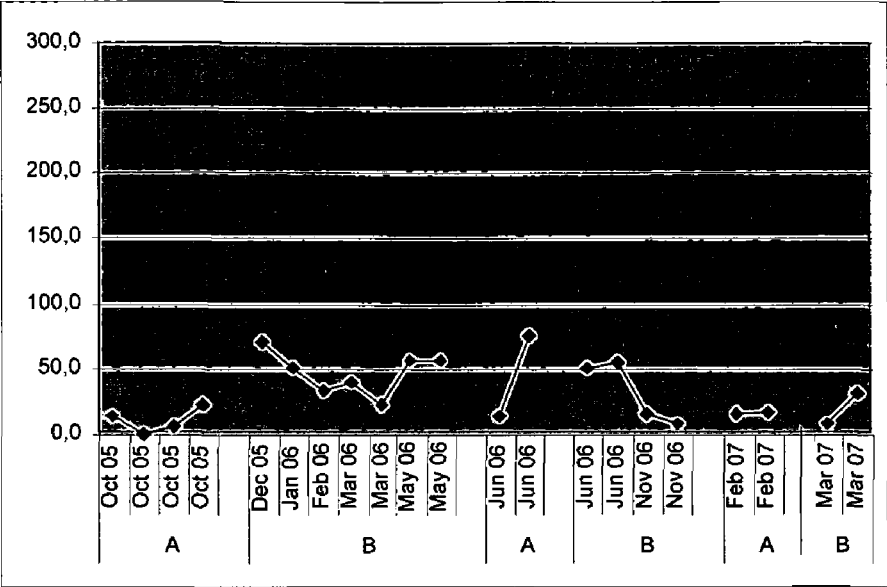
Findings:

Probable gains in *participation*

His participation increased with the introduction of intervention, it then decreased with the first withdrawal of intervention (but increased again before the intervention was returned). With the return of intervention, his participation was higher again. In the new school year (Nov06-Mar07) his participation lowered (the teacher did not change).

Clear gains in norm-referenced expressive language (+6 CI-no)

Clear gains in *loquacity*

Clear gains in *syntactic complexity*

No gains in *grammatical correctness*

Figure D1a.2. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
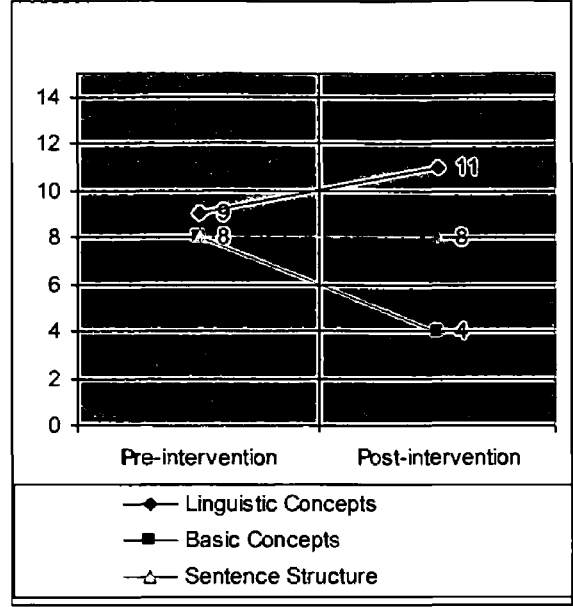
Findings:

Probable gains in norm-referenced *total* receptive language *total score* (+2 CI-o)

Intervening variables:

- He was an international student who spoke non-standard English (African English).

Linguistically and culturally diverse children perform better when tested on processing-dependent subtests than when tested on subtests that require prior knowledge and experience (Laing & Kamhi, 2003). On the expressive language subtest, he improved his performance on two subtests, including strongly processing-dependable Recalling Sentences in Context. His poorer (below the norms for age range) performance on Formulating Labels (which assesses vocabulary) was most likely influenced by differences in experience (cultural and linguistic bias).

- His speech was unintelligible at times and this had an impact on the expressive language score at both pre-intervention and post-intervention assessments.

The grammatical errors present in his speech recorded in the classroom related mostly to the use of morphemes, such as: –ing, plural and possessive –s, past (both, regular –d and irregular) and future tense (e.g., *It mean you are tired; Because he make my dinner; Because the rain come and Noah can die*). The absence of some of these grammatical forms was related to his speech difficulties (e.g., deletion of final consonant –s). He received many teacher requests to repeat utterances.

- Type of utterances: He received fewer teacher obligations in the 3rd intervention phase (B3). This would indicate that a majority of his utterances recorded in this study phase were self-initiated utterances (volunteered).

Self-initiated utterances are likely to be longer than direct responses to obligations. This might partly explain significantly increased scores of loquacity and syntactic complexity in the 3rd intervention phase.

- His participation level was lower only during the 5th recording in the intervention phase (second March recording). During that lesson, children retold a story that was read some time earlier. Perhaps he was absent on the day when the story was originally read or that task presented more difficulties for him because of the memory demands. He was late for school on that day, which could have also influenced his performance.

Conclusion:

Gains were noted in the intervention phase on all dimensions, except *grammatical correctness* (he was a speaker of African English and additionally experienced some speech difficulties). Relative consistency in the lesson content, lesson format, teacher's number of questions and obligations directed towards him (with the exception of 3rd intervention phase) were noted across all study phases. The gains were noted on language dimensions measured both within the classroom context (*loquacity, syntactic complexity, responsiveness, pragmatic appropriateness, participation*) and in a norm-referenced comparison (expressive and receptive language). It can be concluded that SFA probably benefited the language performance of this child. This conclusion must be qualified by the recognition that he received weekly language and learning support in school during the study.

School 4, class D, senior infants

Table **D1**.3. Profile: <u>Child D3</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	5 years 11 months
Language skills pre-intervention	Moderate receptive language disorder Moderate expressive language disorder
Auxiliary services during the study	Daily resource hours from February 06
Family ecology during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	13 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure **D3**.3. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[113]
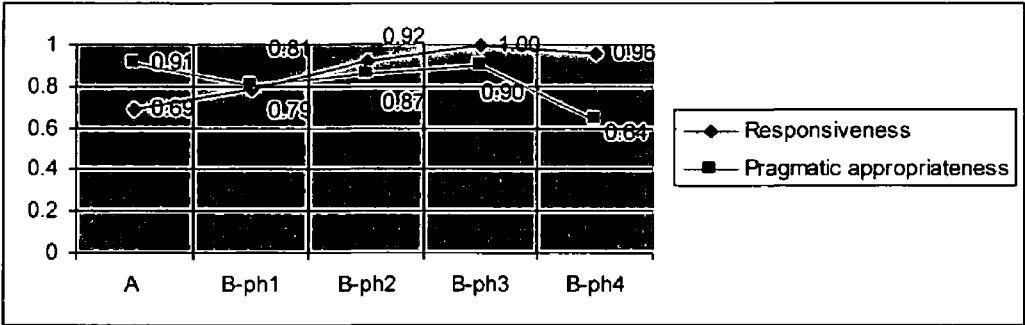
Findings:

Clear incremental gains in *responsiveness* (some decrease in the 4th intervention phase, which was recorded in the new school year)

No change in *pragmatic appropriateness*/Not clear pattern

[113] (A): 4 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 4 recordings, (B4): 2 recordings

Figure D4.3. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A), after the return of intervention (B), during the second withdrawal of intervention (A) and the second return of intervention
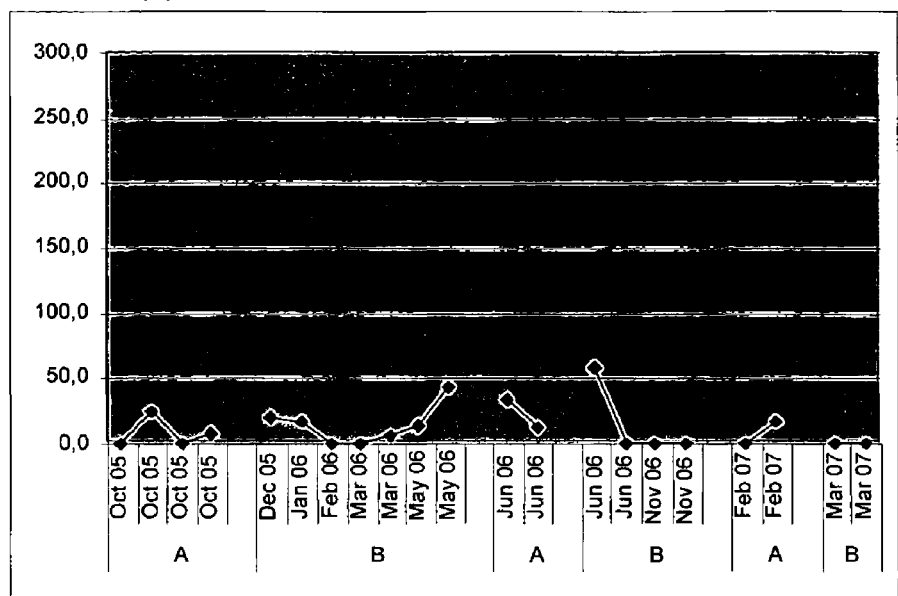
Findings:

No gains in *participation*/Not clear pattern

Probable gains in *loquacity*

Probable gains in *syntactic* complexity

No gains in norm-referenced expressive language

Decrease in receptive vocabulary (-11 CI-o)

Decrease in *grammatical correctness*

Figure D1a.3. CELF **Receptive language** subtests results pre-intervention (CELF-P) and post-intervention (CELF-3)
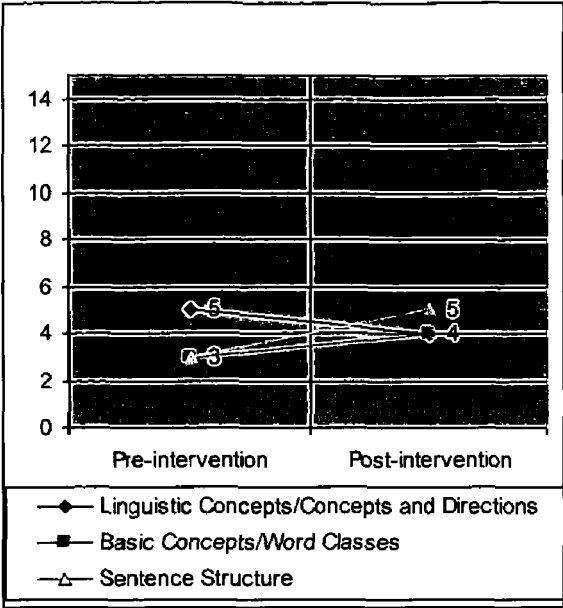
Findings:

Clear gains in norm-referenced receptive language *total score* (+10 CI-no)

Intervening variables:

- Pre-intervention linguistic abilities were assessed by the CELF-P and post-intervention linguistic abilities were assessed by the CELF-3 (see chapter three).

- He volunteered more utterances in the intervention phase than during the baseline.

- He received more teacher obligations in the intervention phases than in the baseline.

- His language sample characteristics in terms of the proportion of word level utterances varied across study phases.

- He received intensive daily resource hours from February 06 until the end of May 06.

This support seemed to have a huge positive impact on his performance in class (from March 06 till June 06) and is reflected in increased scores on *loquacity, syntactic complexity, responsiveness* and *pragmatic appropriateness*. In the new school year (during 4th intervention phase: B4), he was not allocated daily resource hours and this might be reflected in decreases in performance on the above dimensions.

- He received increased teacher attention in the 1st and the 4th intervention phases, when the relationship of the number of teacher's obligations towards him to the number of teacher's questions to the whole class exceeded 1.00.

A decrease in pragmatic appropriateness score in the 1st and the 4th intervention phases could have been partly attributed to the fact that he received an increased number of teacher obligations in these study phases. A higher proportion of his utterances in the 1st and 4th intervention phases was thus constituted by direct responses to obligations. Responses to questions are more likely to be pragmatically inappropriate and inadequate than self-initiated (volunteered) contributions.

Conclusion:

Clear large gains were noted in the norm-referenced receptive language total score despite the fact that this child was reassessed post-intervention with a different version of a test designed for older children and hence of greater difficulty. Some gains might have been attributable to additional support he received at school as well as increased attention paid to him by his teacher after the introduction of the intervention. For instance, clear gains in his language performance in the classroom occurred clearly after he received additional help from a resource teacher (e.g., he started producing multi-clausal utterances, which he conjoined in syntactically complex sentences only from March 06, which was during the 2nd intervention phase). The resource teacher stopped working in the school in June 06 and a decrease in this child's language performance is clearly observable during this time as well as during the next school year. Thus, it cannot be concluded that language gains were attributed to SFA. However, it is likely that gains in responsiveness were supported by SFA as they occurred immediately after the installation of SFA and before this child received intensive support in school.

School 4, class D, senior infants

Table D1.4. Profile: <u>Child D4</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	5 years 2 months
Language skills pre-intervention	Moderate receptive language disorder Moderate expressive language disorder
Auxiliary services during the study	Weekly Learning Support lessons in the school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	13 months[114]
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure D3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[115]
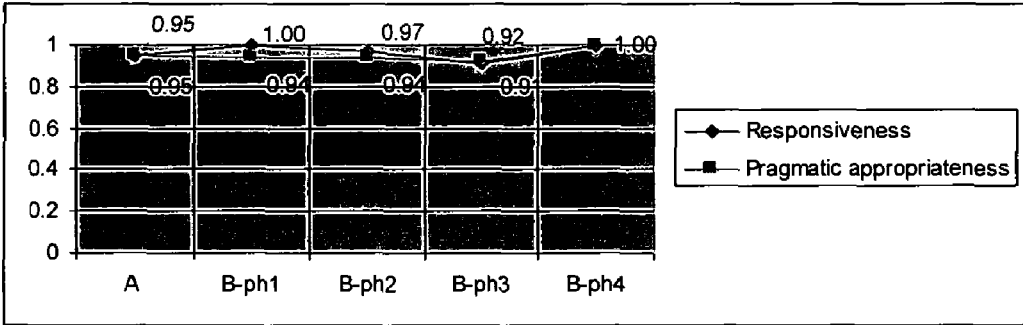
Findings:

No gains in *responsiveness*/No clear pattern

No gains in *pragmatic appropriateness*

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[114] The ABAB design was repeated in this class thus extending the Assessment duration to 16 months. The post-intervention standardised tests administration occurred 13 months after the pre-intervention standardised tests administration.

[115] (A): 3 recordings, (B1): 3 recordings, (B2): 4 recordings, (B3): 4 recordings, (B4): 2 recording

Figure D4.4. Participation pre-intervention (A), after the introduction of intervention (B), during the withdrawal of intervention (A), after the return of intervention (B), during the second withdrawal of intervention (A) and the second return of intervention
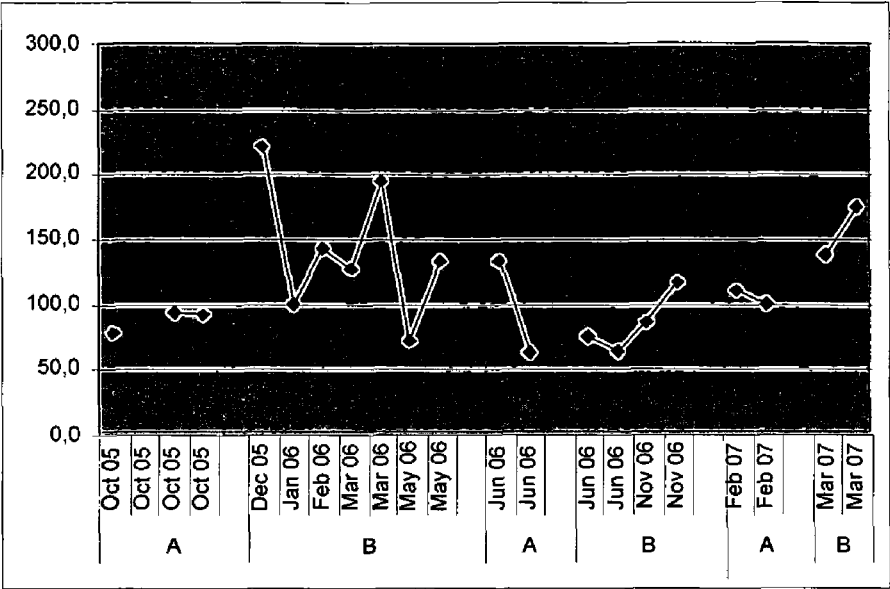
Findings:

Clear gains in *participation* (follows ABAB design)

His participation level increased with the introduction of intervention. It exhibited irregular pattern during the first intervention phase (1-7 intervention recordings) and during the first withdrawal of intervention. In the new school year (Nov06-Mar07) it decreased during the second withdrawal of intervention (Feb07) and increased with the return of intervention.

Gains in *loquacity* from 3rd intervention phase

Gains in *syntactic complexity* from 3rd intervention phase

No gains in *grammatical correctness*

No change in norm-referenced expressive language

Figure D1a.4. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
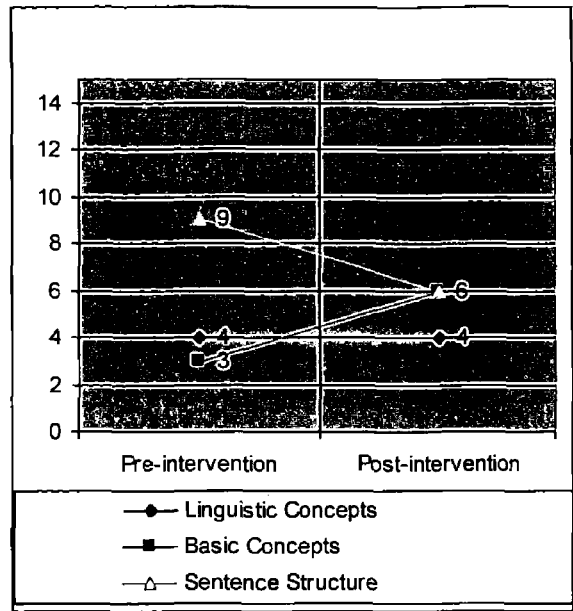
Findings:

Clear gains in norm-referenced *total* receptive language score (+7 CI-no)

Intervening variables:

- The number of clause utterances produced by him pre-intervention and after the introduction of intervention (with the exception of the 3rd intervention phase) was comparable.

- Lesson content:

There were some phonological awareness lessons recorded in the 3rd phase of the intervention. Some word level responses might require specific knowledge (e.g., *What word rhymes with Ben*), while specific knowledge may not be needed in responding to text level tasks (e.g., *What do you think this story is going to be about*). Perhaps, this specific knowledge requirement was the reason why this child's *responsiveness* score decreased in B3 phase.

- Time of the year: His participation level dropped at the end of June 06 (the last three recordings during the first school year). It might have been that the weather and the time of the year (i.e. the end of the school year) confounded the ABAB pattern in participation during the first school year (that pattern is clearer in the next school year).

Conclusion:

Clear gains in *participation* were noted (clear ABAB design). No immediate gains were noted on *loquacity* and *syntactic complexity* dimensions. Clear gains were noted also in the norm-referenced receptive language total score. It can be concluded that the intervention probably benefited this child's language performance in the classroom.

School 5: DEIS Band 1 school

Class C, junior infants

Table C.1. Profile: Class C

Geographical area	Ballyfermot
Age of the class	Junior infants
Start of the intervention	SFA installed at the start of the school year (Nov)
Group/Class size (averaged from all recordings)	20 (>15; 'large')
Classroom size (inter-observer agreement)	Large room
Teacher's use of SFA	Teacher wore the microphone every day the researcher arrived

Narrative for the class

The teacher of class C was recorded to present all observed elements of good quality of language teaching. She created a very positive warm classroom climate in which children were encouraged to initiate speaking. This teacher displayed a consistently good use of language stimulation techniques with a specific focus on extending children's conversational turns. The observed children received increased teacher attention in the intervention phase (i.e. increased number of teacher obligations), in comparison to the baseline. This observation needs to be taken into account when interpreting the observed gains. Dialogic story reading was the most common model of the recorded language lessons.

Class summary

A majority of children in this class showed gains on a majority of dimensions, both those observed within the classroom context (participation, responsiveness and pragmatic appropriateness) and those measured in a norm-referenced comparison (receptive language).

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Table C1.1. Profile: <u>Child C1</u>

Gender	Female
Status	Attention difficulties
Age at the start of intervention	4 years 2 months
Language skills pre-intervention	Mild receptive language disorder Moderate expressive language disorder
Auxiliary services during the study	Weekly resource hours in the school
Family situation during the study	Teacher was not aware of any changes
Exposure to intervention	7 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure C3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[116]
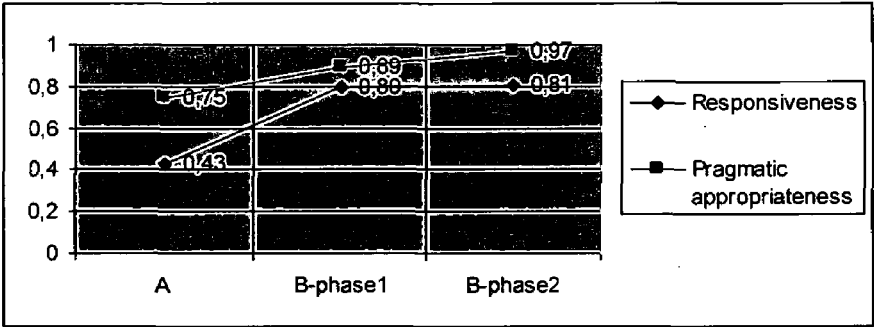
Findings:

Clear gains in *responsiveness*

Clear gains in *pragmatic appropriateness*

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[116] (A): 3 recordings, (B1): 4 recordings, (B2): 4 recordings

Figure C4.1. Participation pre-intervention (A) and after the introduction of intervention (B)
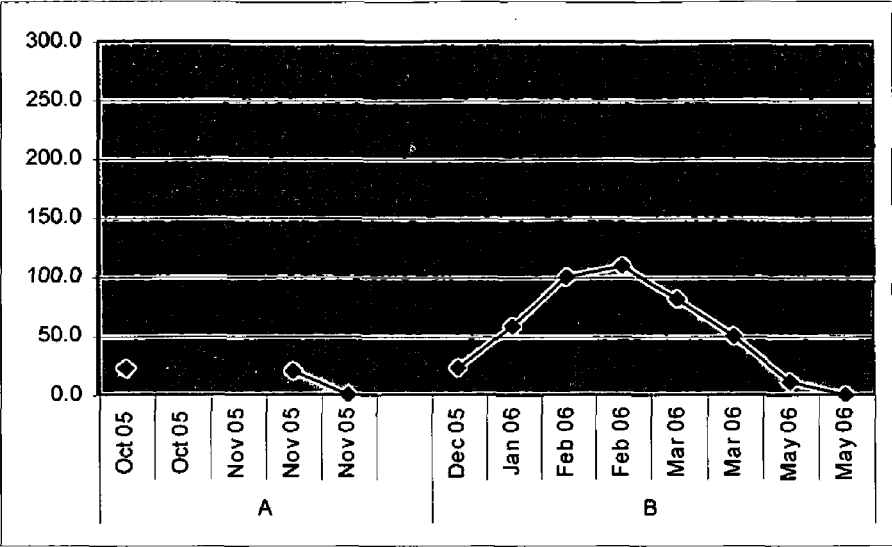
Findings:

Probable gains in *participation*

Her participation increased from the 2nd intervention recording onwards. It exhibited, however, a decreasing pattern from March 06 and it was very low in May 06.

Clear gains in *grammatical correctness*

No gains in norm-referenced expressive language (-3 CI-o)

Figure C1a.1. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
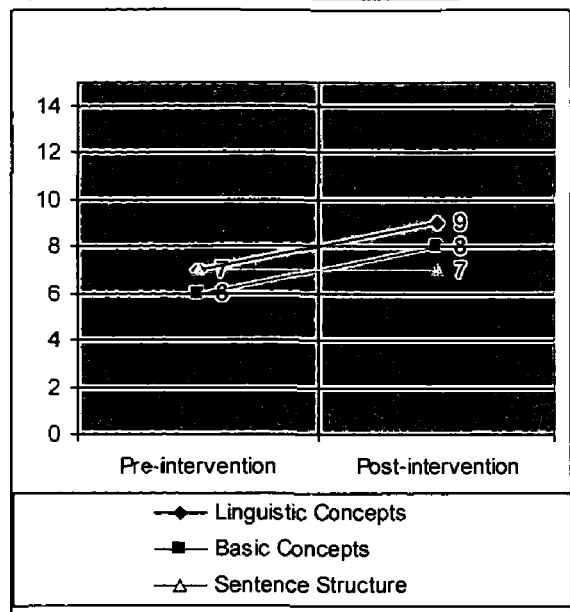
Findings:

Clear gains in norm-referenced receptive language *total* score (+5 CI-no)

Intervening variables:

- She produced significantly more utterances in the intervention phase than in the baseline. The baseline language sample was much poorer in the number of utterances.

A higher proportion of her utterances produced in the intervention phases were grammatically correct utterances. Also, her *pragmatic appropriateness* score increased despite the increased number of utterances (and clausal utterances within them), although longer and syntactically complex utterances are more likely to be pragmatically inappropriate than single word and phrase utterances (Scott, 1995).

- Teacher directed a greater number of obligations towards her after the introduction of intervention than in the baseline.

- Use of ICT in language lessons: Animated story on a computer screen during 4th recording (1st intervention phase)

Her participation was highest during the 4th intervention recording (second February recording). Children listened to a story from a computer during this lesson and a high participation level was noted for all observed children in this class. Some researchers found that comprehension of stories (and the ability to remember vocabulary) is enhanced when stories are presented on a computer screen and supplemented with multimedia (animated stories with sound and music) (Verhallen *et al.*, 2006).

Conclusion:

Language gains were observed both within the classroom context (*responsiveness, pragmatic appropriateness, grammatical correctness, participation*) and in a norm-referenced comparison (receptive language). Gains in *pragmatic appropriateness* and *grammatical correctness* dimensions show an incremental pattern, suggesting some maturation effect. This child received increased teacher attention after the introduction of intervention, which probably additionally supported her language acquisition. Furthermore, she received resource hours in school on a weekly basis. It must be emphasised, however, that substantial gains were noted already in the 1st phase of intervention and on dimensions that are less dependent on the richness of the language sample (e.g., *responsiveness* as opposed to *syntactic complexity*) as well as in the norm-referenced comparison. It can thus be concluded that the intervention probably benefited this child's language development.

School 5, class C, junior infants

Table C1.2. Profile: <u>Child C2</u>

Gender	Male
Status	Attention difficulties
Age at the start of intervention	4 years and 4 months
Language skills pre-intervention	Severe receptive language disorder Within norms for age expressive language
Auxiliary services during the study	Weekly resource hours in the school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure C3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[117]
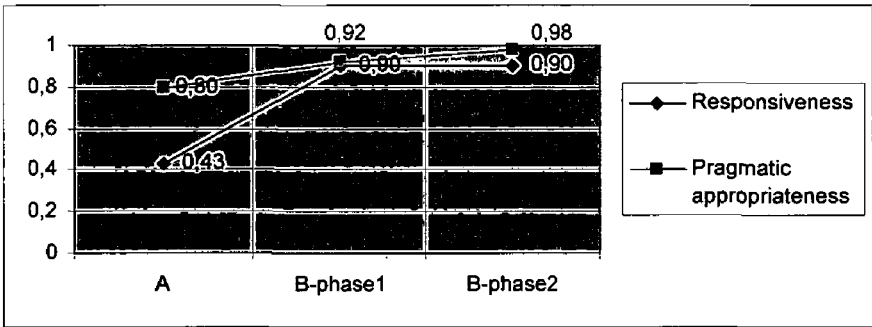
Findings:

Clear gains in *responsiveness*

Clear gains in *pragmatic appropriateness*

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[117] (A): 4 recordings, (B1): 4 recordings, (B2): 4 recordings

Figure C4.2. Participation pre-intervention (A) and after the introduction of intervention (B)

Findings:

Probable gains in *participation*

His participation increased significantly from February 06 onwards. It exhibited a decreasing pattern towards the end (lower participation in May 06).

No gains in norm-referenced expressive language (-17 CI-no)

Decrease in *grammatical correctness*

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Figure C1a.2. CELF-P **Receptive language** subtests results pre-intervention and post-intervention

Findings:

Clear gains in norm-referenced receptive language *total* score (+8 CI-no)

Intervening variables:

- He received a greater number of teacher obligations after the introduction of intervention than in the baseline.

- He produced significantly more clausal utterances in the intervention phase than in the baseline.

- Time/weather: His participation lowered in May, especially during the last recording. It could have been affected by the hot weather in May 06.

- The use of ICT: Animated story on a computer screen during 4th recording

See 'Intervening variables' in a case study of child C1 from this class for elaboration.

Conclusion:

Clear gains were noted on most dimensions, both those observed within the classroom context (*responsiveness, pragmatic appropriateness, participation*) and those measured in a norm-referenced comparison (receptive language). It can be concluded that the intervention clearly supported this child's language development. This conclusion needs to be qualified by the following two observations. First, the teacher was observed to pay increased attention to this child in the intervention phase and, secondly, this child received weekly resource hours in school.

Table C1.3. Profile: <u>Child C3</u>

Gender	Female
Status	Attention difficulties
Age at the start of intervention	4 years 4 months
Language skills pre-intervention	Mild receptive language disorder She was not assessed on expressive language[118]
Auxiliary services during the study	Weekly resource hours in school
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure C3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[119]
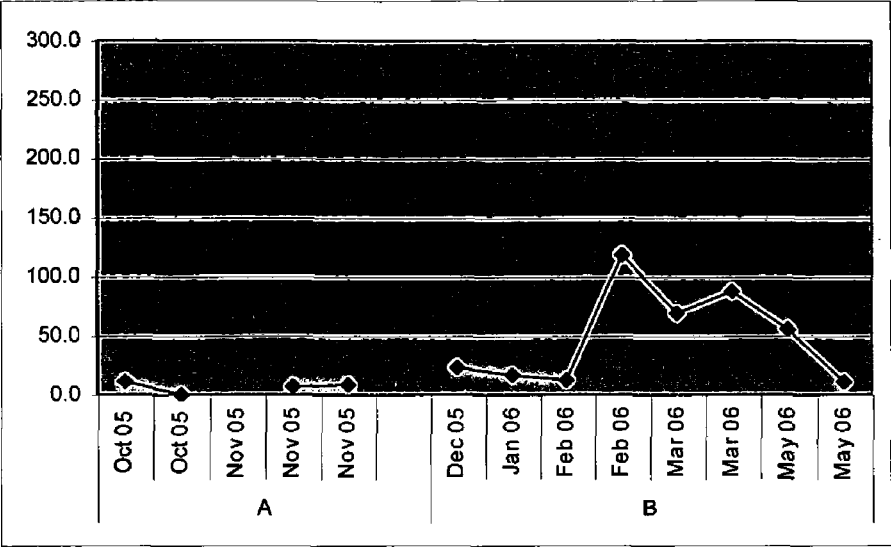

Findings:

Clear gains in *responsiveness*

Decrease in *pragmatic appropriateness*

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[118] She was very apprehensive and cried on the day of scheduled assessment. She was absent on another day of scheduled assessment. As a result, expressive language test was not administered to her.
[119] (A): 4 recordings, (B1): 4 recordings, (B2): 3 recordings

Figure C4.1. Participation pre-intervention (A) and after the introduction of intervention (B)
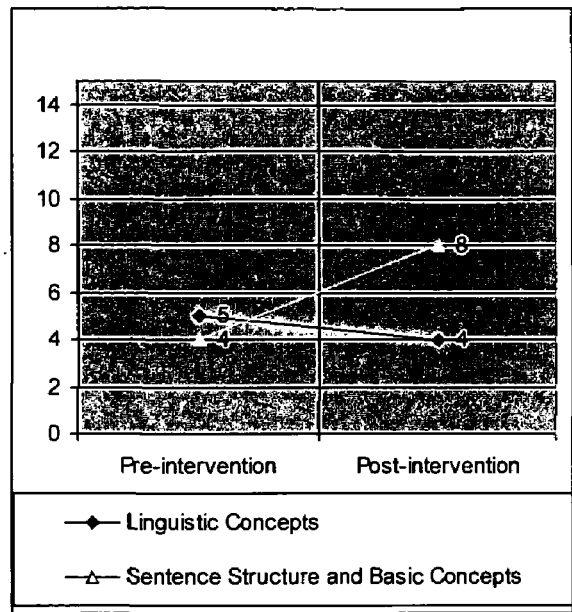

Findings:

Probable gains in *participation*

Her participation increased from 2nd intervention recording onwards. It was low only during the 7th intervention recording (second last recording).

No gains in *grammatical correctness*

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Figure C1a.3. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
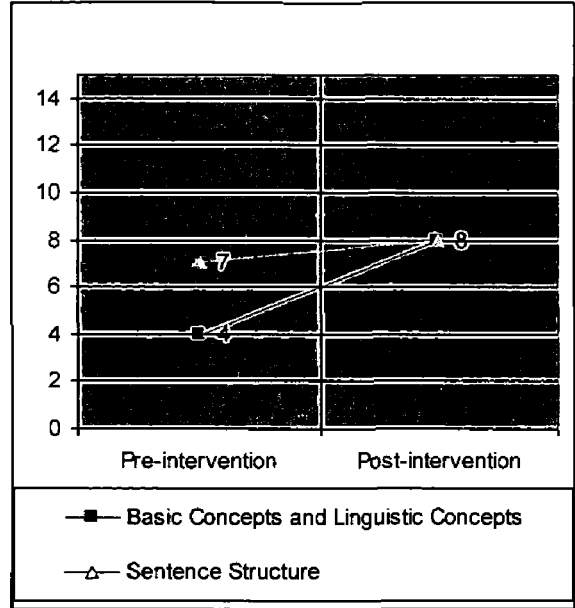
Findings:

Clear gains in norm-referenced receptive language *total* score (+13 CI-no)

Intervening variables:

- She produced more utterances in the intervention phase than in the baseline.

- Teacher directed greater number of obligations towards her after the introduction of intervention than in the baseline.

- The use of ICT: Animated story on a computer screen during 4th recording

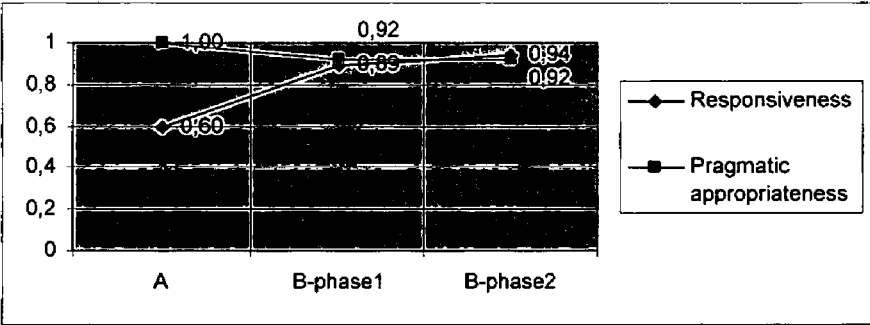See 'Intervening variables' in a case study of child C1 from this class for elaboration.

Conclusion:

Clear language gains were noted both in the classroom context (*responsiveness, participation*), and in a norm-referenced assessment. She started volunteering more contributions and her *responsiveness* improved significantly after the amplification was introduced. The observed decrease in *pragmatic appropriateness* in the 1st intervention phase could have been due to the increased number of clausal utterances produced after the introduction of intervention. As to interpretation of gains, it must be noted that the teacher directed significantly more obligations towards this child after the introduction of intervention (which resulted in a much richer language sample) and this increased attention could have accounted for some gains. It can be concluded that SFA clearly supported this child's language development. This conclusion needs to be qualified by the recognition that she received weekly resource hours during the study.

Table C1.4. Profile: <u>Child C4</u>

Gender	Female
Age at the start of intervention	5 years 2 months
Language skills pre-intervention	Mild receptive language disorder Severe expressive language disorder
Auxiliary services during the study	Weekly resource hours in the school.
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	7 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure C3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[120]
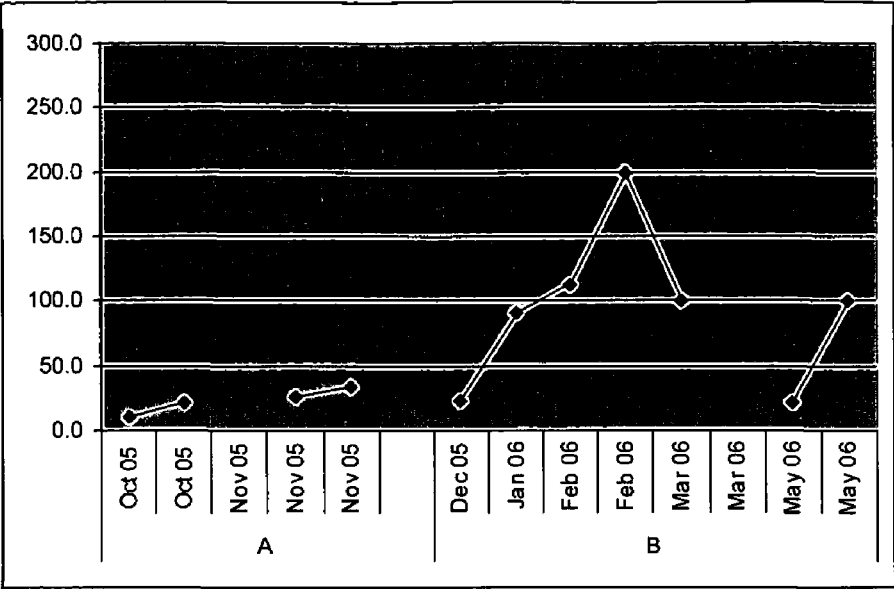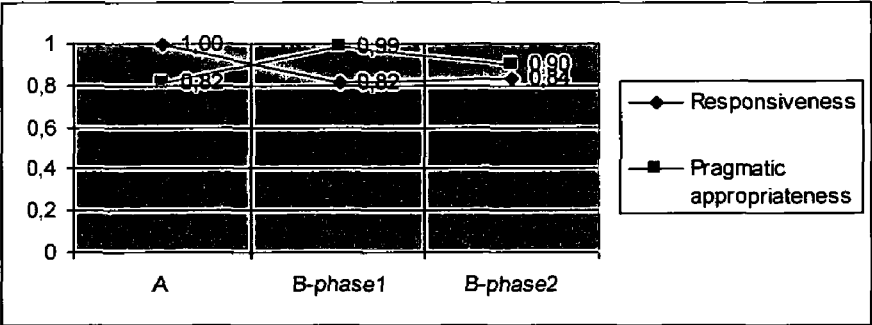

Findings:

Probable gains in *pragmatic appropriateness*

Decrease in *responsiveness*

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[120] (A): 2 recordings, (B1): 3 recordings, (B2): 4 recordings

Figure C4.4. Participation pre-intervention (A) and after the introduction of intervention (B)
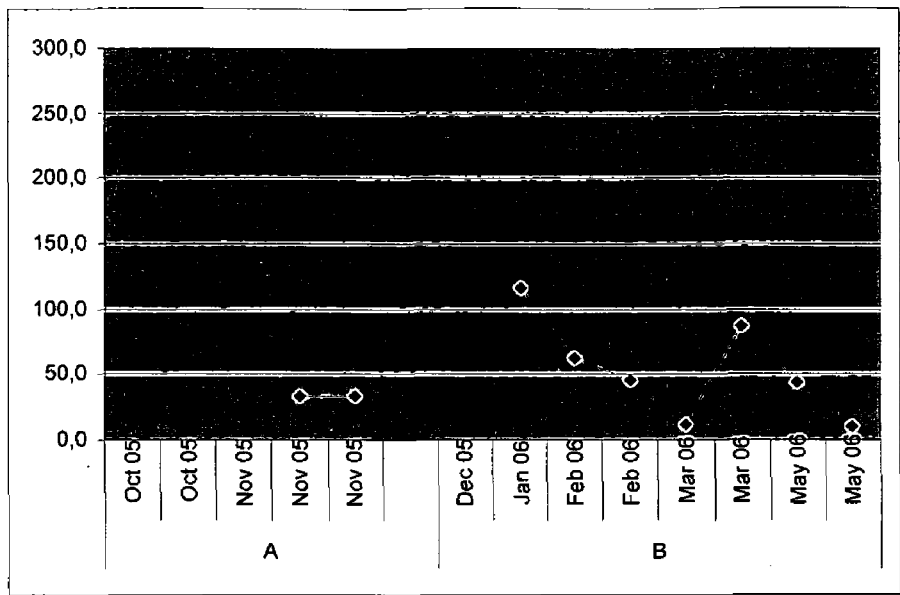
Findings:

Probable gains in *participation*

Her participation increased after the introduction of intervention. It was, however, very low during 5th and 8th intervention recording.

No gains in norm-referenced expressive language

No change in *loquacity* and *syntactic complexity*

Decrease in *grammatical correctness*

Figure C1a.4. CELF-P **Receptive language** subtests results pre-intervention and post-intervention
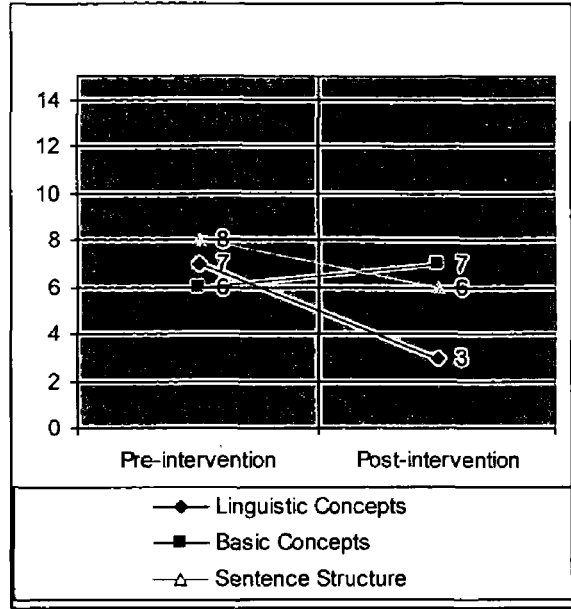
Pre-intervention   Post-intervention

—◆— Linguistic Concepts
—■— Basic Concepts
—△— Sentence Structure

Findings:

No gains in norm-referenced receptive language *total* score (-13 CI-no)

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Intervening variables:

- This child's speech exhibited phonological and phonemic difficulties.

She, for instance, deleted final consonants and this affected the morphological structure of her words (e.g., she did not 'pronounce' plural –s, nor –s possessive). Her speech was assessed by a community-based speech therapist in February 06 but she was waiting for intervention. Her speech disorder remained severe in type at the end of the study. Perhaps the experience of having her speech assessed at the end of February impacted on her confidence to speak. After this assessment, she seemed to be 'aware' of the fact that her speech could be unintelligible and she was observed to cover her mouth with her hands while speaking in the classroom. This could have influenced negatively her *responsiveness* score.

- Teacher directed a greater number of obligations towards her after the introduction of the intervention than in the baseline.

Increase in the number of teacher's obligations impacted on the number of utterances she produced. She produced many more utterances in the intervention phases than in the baseline.

Conclusion:

Some increase in the *pragmatic appropriateness* dimension as well as immediate clear gains in *participation* were noted after SFA installation. This could suggest that she was able to hear the teacher's obligations/questions better. She received more teacher attention after the introduction of the intervention and this might have supported her comprehension/participation. Gains were not observed on any other studied dimensions. Her speech exhibited phonological processes inappropriate for her age and it is likely that this phonological impairment hindered further language development. Her self-awareness of her speech problems increased towards the end of the school year and might have impacted on performance in such academic domains as *responsiveness* and *participation*, especially in the 2nd intervention phase. It can be concluded that SFA was likely to support this child's participation and pragmatic appropriateness of her utterances, as immediate gains on these two dimensions were noted. This conclusion needs to be qualified by the recognition that she received weekly resource hours in school during the study. It is possible, however, that her speech disorder impacted negatively on this child's language development.

4.2 Factors Observed to Affect Children's Language Performance in the Study

This section presents a system of elements that were observed to affect the language performance of the participants in the study, including a summary of the factors that are discussed as intervening variables in case studies presented in this chapter.

4.2.1 Teacher-Child Relationship

Increased teacher attention (quantitatively measured as the relationships of the number of teacher questions directed to the whole class to the number of teacher obligations directed to the observed child) was found to support language gains in some classes (see case studies of class B and class H). In other words, scores on language dimensions observed in the classroom were higher during the lessons when the teacher posed more obligations to the observed children than during the lessons when these children received fewer teacher obligations.

Children in class M received increased teacher attention in the intervention phase as well as a plethora of school-based supports (e.g., resource hours and one-to-one therapeutic supports available under the school completion programme). Despite this increased level of support, gains were observed in this class only for child M4 who underwent grommet insertion at the start of the intervention phase (language gains can be largely attributed to this minor surgery). In class M, the teacher was consistently observed *not* to shift the power relations in favour of the children, not to enable expository discourse, to pose many closed questions and to discourage initiations during story reading. Most importantly, the teacher of class

M was frequently observed not to wear the microphone. It appears thus that the quality of language teaching may be a factor *enabling* the efficacy of the intervention (see chapter six for elaborated discussion on this).

Child K4 was observed to receive frequent negative feedback from the teacher. In line with the hypothesis that a warm supportive relationship with an adult is an important factor contributing to language development (as argued in chapter two), the performance of child K4 was noted to decrease on most language dimensions, both those measured in the classroom and in a normative comparison.

4.2.2 Time of the Observation

Interestingly, the time of the year was observed to influence student participation levels in the class (as measured by the total number of combined 'volunteering for response' (HA) and non-obligated responses to the number of teacher's solicitations for verbal response). The participation in 5 classes (out of 14; 36%) of different age level and in different schools tended to be higher in February and March than in any other months, namely classes: A-senior infants, C-junior infants, O-first class, B-junior infants, F-first class and K-first class (see case studies of classes A, C, B in this chapter and graphs in appendix S). Participation of *most* study participants was observed to clearly lower in May and June, which could have been influenced by warmer weather and holiday anticipation effect. This was clearly observable, for example, in class L, class E, class N, class C and child D4 during May and June 2006. Furthermore, classroom participation lowered also before Christmas and on Mondays in class E, while participation scores tended to be lower after the withdrawal of the intervention period in class C, even if the intervention was re-introduced.

For a few children (8 out of 63, 13%) from different schools, classes and of different age level and gender (children: M-M4, F-N3, F-A2, M-B2, M-H1, M-H3, M-K1, M-K5), participation was very high during the 1ˢᵗ baseline recording and lower for the other baseline recordings. In the case of a small number of children (11 children out of 63, 17%) from different schools, classes and of different age level and gender (children: F-N4, M-G4, M-J1, F-J2, F-J3, F-J4, F-O3, F-L2, F-C4, M-D2, M-D4), participation increased during the 1ˢᵗ recording after the introduction of amplification (1ˢᵗ intervention recording) and then decreased for subsequent intervention recordings. This could have reflected a 'novelty' effect.

4.2.3 Classroom Activities/Lesson Content

Familiarity with the lesson content and lesson vocabulary

Higher classroom participation was noted if the children were familiar with the lesson content and format, e.g., during discussing Christmas or a known story or during a known activity (i.e. activity frequently repeated in the class) such as sentence assembly tasks in class K (e.g., class J, child E3 and child K1). Conversely, lower responsiveness and pragmatic appropriateness scores were noted if the teacher required the pupils to label unfamiliar objects or if she/he used or elicited vocabulary likely to be unfamiliar to them (e.g., *You are going to be a dentist/what are you going to examine, What are these birds called, What's an extension*; see case studies of class L, class A and class E in this chapter). Specific knowledge demands seemed to affect responsiveness of child D4 (e.g., *What rhymes with Ben*), participation in class K during biology lessons, participation in

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class G during literacy class (e.g., *What letter comes next*) and participation in class H during a mathematics lesson.[121]

Level of abstraction of the lesson

Classroom participation was observed to be higher if the level of abstraction of the lesson was lower. This was observed for example in class B in which high participation level was recorded when pupils were engaged in labeling animals on pictures. The perceptual level of utterances, determined by the classroom activity and the nature of the teacher's questions, was observed to affect the grammatical correctness and the pragmatic appropriateness of children's utterances. The more demanding the tasks (i.e. the more 'abstract'), the fewer adequate, complete and relevant responses were produced, and conversely, if the task was less demanding (e.g., labelling objects/events), the responses tended to be more adequate, relevant and complete.

Type of classroom language activity

Descriptive and reporting language was recorded to invite longer sentences (e.g., *He likes chocolate and he goes to swimming, He took the duck and the duck bite his hand off*). Phonics/phonological awareness activities were observed to usually encourage high classroom participation as children contributed, for instance, words starting with a particular letter (see case studies of class H in this chapter). Phonics lessons differed significantly from language lessons based on stories or topic discussions. This difference impacted on the characteristics of the language samples recorded and the number of clausal utterances produced by the

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[121] These examples represent the type of word level tasks that are more likely to require specific knowledge.

students (e.g., class E). Certain activities, such as discussing posters, for instance, tended to evoke routine responses.

Cognitive demands of the lesson

Cognitively demanding tasks were observed to invite syntactically complex sentences. For example, child H2 was observed to produce complex sentences only during story time when predicting future events of the story and justifying his predictions. On the other hand - in contrast to syntactic complexity scores - classroom participation, responsiveness and pragmatic appropriateness were observed to lower in some situations when cognitive and memory demands of the lesson increased. This was observed, for example, in class B, class A and for child D2, when students were asked to recall information from previously read stories, and in class G when students were expected to formulate questions to previously heard stories. In another class (class B) children with weaker baseline language skills provided more pragmatically inappropriate and inadequate responses when faced with questions that placed higher cognitive demands such as *How are you different from other people?* On the other hand, however, one might predict that certain level of challenge is needed to maintain good participation level in the class. One child's participation (class E) lowered for example while he was recorded saying *Teacher I am bored.*

4.2.4 Absenteeism/Lateness in School

Responsiveness and participation levels were observed to be lower after some children's prolonged absence from school (see, for instance, a case study of child

B6 in this chapter). Child D2 was observed to have lower participation levels on a day he was late for school by more than 30 minutes.

4.2.5 Additional Resource Hours in School

Classroom language performance of one child from class D was observed to be clearly linked to the level of out-of-class support that he received for a period of time during the intervention phase. This child's scores in participation, responsiveness and loquacity increased when he started receiving *daily* resource hours in school and decreased when this daily support ceased. Interestingly, however, this child's norm-referenced performance at the end of the study did not show any gains.

4.2.6 Baseline Speech Language Hearing and Attention Profile

There were 19 children who gained in receptive language (Table 16). As many as 15 of them (79%) were identified as language-disordered at the baseline assessment (79%), while 8 (42%) were considered by their teachers to have attention difficulties pre-intervention. In general, a majority of the students whose baseline profiles were indicative of a receptive language disorder made norm-referenced gains (61%, 14 out of 23), with fewer than half of those showing large gains of more than 8 standardised scores (29%, 4 out of 14). Only a small number of students whose baseline *expressive* language profiles were indicative of a language impairment made norm-referenced gains (20%, 5 out of 25).

A majority of participating children identified by their teachers as experiencing attention difficulties pre-intervention gained in receptive language (8 children out of 10, 80%; compared to 58% of the whole sample who gained in this

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dimension). As regards expressive language and receptive vocabulary, fewer than half of the children identified by their teachers as having attention difficulties pre-intervention gained in these dimensions, namely 3 children gained in expressive language (out of 11, 27%) and 4 children gained in receptive vocabulary (out of 13, 31%). A small majority of the children identified by their teachers as experiencing attention difficulties pre-intervention actually deteriorated in norm-referenced performance on expressive language (53%) and receptive vocabulary (53%).

Significant gains in responsiveness were observed for two study participants from two different classes. One participant was a child from class E who was perceived by his class teacher as having hearing difficulties and another participant was a child from class A, who was *not* suspected by the class teacher to have hearing difficulties. Following the observation of substantial gains in responsiveness after the SFA installation, the responsiveness of these two participants was then observed in ABAB design. Very clear ABAB design in *responsiveness* was observed for both of them (see case studies of class A and class E in this chapter). The case of these two children indicates that SFA has a potential to aid the ability to participate in the classroom activities, i.e. to respond to the teacher obligations, for children who might have some undetected hearing difficulties.

4.2.7 Teachers' Stimuli and Characteristics of Language Samples

The teachers' stimuli (i.e. the number of questions and obligations directed by the teacher) and the characteristics of language samples gathered in the classrooms were monitored during the study. This allowed observations of the changes in the language sample productivity levels, the type of children's

responses (e.g., single word responses versus clausal responses) and the changes in the number of teachers' elicitations for language. All of the above was recorded in terms of its impact on performances on individual language dimensions measured in naturalistic settings.

The likelihood of occurrence of certain linguistic features may be greater if the linguistic material is richer, for example, the more utterances the child produces the greater is the likelihood that he/she produces complex sentences (Lund, 1993). Although it was the *proportion* of certain linguistic features in each study phase that was taken into consideration (and not its mere occurrence as it would be the case with, for example, checklists), the differences in the wealth of linguistic material produced by children after the introduction of the intervention must be interpreted together with the findings of this study, particularly for children who had scores 0.0 at baseline. The following table 3 illustrates changes in the wealth and characteristics of language samples for the whole sample (see appendices C-G for data on individual study participants).

Table 3 Language sample characteristics in each study phase: Baseline (A) and intervention (B) phases

	All utterances		
	Number of all utterances		
	MEAN	SD	Range
A	34.79	16.70	12-81
B-phase 1	54.65	26.44	15-120
B-phase 2	54.79	32.75	16-194
B-phase 3	44.11	15.89	21-91

	Clause utterances		
	Number of all utterances		
	MEAN	SD	Range
A	19.34	15.62	0-75
B-phase 1	24.13	17.48	0-94
B-phase 2	37.43	29.62	12-179
B-phase 3	33.44	5.86	22-45

	Word level utterances		
	Proportion (1.00 = 100%)		
	MEAN	SD	Range
A	0.10	0.14	0.00-0.71
B-phase 1	0.08	0.11	0.10-0.41
B-phase 2	0.08	0.13	0.11-0.55
B-phase 3	0.06	0.06	0.17-0.21

The quantification from the above table 3 shows that, on average, children produced more utterances after the introduction of the intervention. Furthermore, in comparison to the baseline data, there were more clause utterances recorded in the intervention phases, however, with significant variability among participants (high SD, wide range). Change in the number of clause utterances after the introduction of the intervention could have been influenced by at least two factors. Firstly, on average, the teachers were found to pose more obligations to the observed children in the intervention phase (see table 4 below and appendix F, for the exact figures) thus eliciting more responses. Secondly, more productive language samples probably reflected the SFA impact on classroom verbal participation. Self-initiated

utterances are more likely to be longer and syntactically complex than answers to direct questions, which can be limited to phrases or single words (Scott, 1995).

The majority of gains in loquacity and syntactic complexity occurred either in the last or second last phase of the study, or exhibited incremental pattern. This suggests that gains in those two dimensions could not have been attributed solely to the changes in the language sample characteristics as if they were, immediate changes (i.e. in the first intervention phase) would have been noted and some decrease on those dimensions would have been observable in the last study phase (when the wealth of language samples decreased).

It is generally assumed that when the linguistic material is richer in clausal utterances (with fewer single word responses), there is a greater likelihood that some responses may be grammatically incorrect and pragmatically inappropriate (Scott, 1995). This was *not* the case in the present study. In contrast, gains were noted in pragmatic appropriateness dimension and 'no change' outcome (as opposed to a decrease) was recorded in grammatical correctness dimension in the intervention phase. In other words, children provided more pragmatically appropriate and adequate responses after the introduction of the intervention, even though an increased number of their responses were longer and syntactically complex.

The following table 4 illustrates changes in the teachers' stimuli across the duration of the study for the whole sample.

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Table 4 Teacher's stimulus in each study phase: Baseline (A) and intervention (B) phases

	Teacher obligations to student (number)			Teacher attention to student[122] (index)		
	MEAN	SD	Range	MEAN	SD	Range
A	4.24	3.07	0.00-18.30	0.40	0.30	0.00-1.32
B-phase 1	6.82	4.30	0.00-20.00	0.54	0.33	0.00-1.34
B-phase 2	7.88	5.21	0.00-26.00	0.63	0.45	0.00-1.62
B-phase 3	4.74	2.82	1.80-11.80	0.45	0.27	0.17-1.07

The quantification from the above table 4 shows that the teachers directed more obligations after the introduction of the intervention (during 1st and 2nd intervention phase, which in most cases occurred in March and April) than in the baseline. The teacher attention and the number of teacher obligations directed to the observed children decreased in the 3rd intervention phase which occurred in May and June. This could have been partly influenced by warmer weather and holiday anticipation effect, as well as by the fact that the teachers became accustomed to being videotaped. The following table 5 illustrates the number of teachers' questions[123] directed to the whole class across the duration of the study.

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[122] 'Teacher attention to student' was measured as the relationship of the number of teacher obligations directed to individual pupils to the number of teacher questions directed to the whole class. A score of 1.00 or above suggests increased teacher attention (see chapter three).
[123] See appendix A for the definition of 'a question' adopted in this study.

Table 5 Mean number of teacher's questions posed to the whole class in each study phase

Class code	Time[124]	A Baseline	B1 Intervention phase 1	B2 Intervention phase 2	B3 Intervention phase 3
Class C	15mins	10.0	11.0	10.0	
Class E	15mins	6.0	8.0	5.7	8.0
Class A	15mins	9.7	15.5	13.5	12.0
Class B	15mins	8.5	12.6	10.8	
Class D	20mins	11.50	9.30	16.80	11.50
Class M	20mins	12.0	8.8	7.3	
Class L	20mins	8.3	8.0	10.0	
Class F	20mins	11.7	10.3	11.0	8.0
Class O	20mins	8.0	12.3	7.0	
Class K	20mins	8.3	10.3	15.0	
Class H	25mins	8.3	10.8	17.0	
Class J	25mins	16.5	13.0	23.0	
Class N	30mins	16.0	24.0	21.0	
Class G	30mins	15.8	14.3	17.0	

As it can be seen from the above table 5, fewer than half of all teachers (5 out of 14) posed consistently more questions to the class (i.e. elicited 'more language' from children) after the introduction of the intervention (classes A, B, K, H and N). In three of these classes, namely classes: A, B and N, gains were noted in a majority of language dimensions observed in the classroom (see case studies in this chapter and tables 6-14 in chapter five). However, gains in a majority of language dimensions observed in the classroom were also noted in classes D, C and G, in which the teachers did not elicit 'more language' from the children after the introduction of the intervention (see table 5 above for the exact figures). Furthermore, gains in a majority of language dimensions observed in the classrooms were not noted in classes K and H, although the teachers of those

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[124] Teachers' questions were quantified for a specific time period for each class during which the teachers presented whole class teaching (see chapter three).

classes posed more questions after the introduction of intervention (see table 5). This indicates that the teacher's stimulus could not have been the sole factor contributing to the observed gains.

The above quantification of teacher questions was presented to show differences in the teachers' stimuli across study phases. It should not be used to formulate any judgment on teaching styles. Judgment on teaching style should not be made on the basis of linguistic material gathered from the classroom as surface features of language do not provide evidence of anything that is of non-linguistic nature (Stubbs, 1993, p. 62). The number of teacher's questions is not a measure of the quality of language teaching (Girolametto et al., 2000). Various authors indicated that less directive models of teaching such as the use of modelling and comments facilitates children's language development in a better way than use of directive or interrogative language (e.g., Girolametto et al, 2000; Weitzman & Greenberg, 2002). However, it must be noted that the definition of a 'question' in this study was equal to an 'elicitation for language' and that the interrogation of form was not a criterion for coding questions (see appendix A).

Classrooms were shared by on average 15 pupils who took turns talking. These contextual constraints and the many variables affecting the occurrence of syntactically complex formations affected the wealth of linguistic material gathered from each recording.

4.2.8 Factors Affecting Standardised Tests' Results

Familiarity with the examiner and practice effect are two variables that are frequently considered while interpreting test-retest results of standardised tests in longitudinal studies (Summers, 1996).

Familiarity with the examiner

Although a significant majority of participants were retested post-intervention by the same examiner who administered the baseline test, a few children were retested post-intervention by a different examiner. Four children were assessed post-intervention by a different speech and language therapist who started working in the participating schools at the end of the study (see chapter three). It was found that gains in the present study could not have been solely attributed to the level of familiarity with the examiner as children who were retested post-intervention by a different examiner gained in performance. Norm-referenced gains were noted for all 4 children who were retested by a different examiner.

Practice effect

A small number of children were retested post-intervention with a different version of a test than pre-intervention (see chapter three and appendices I-J for details on correlation of the different test versions). Four children were retested with the CELF-Preschool 2 (2nd modified edition of the CELF-Preschool) by a different speech and language therapist and 17 children were retested with the CELF-3UK (version for older children) as they reached 7 years old during the time between pre- and post-intervention assessments (these 17 children were retested by the same examiner). It was found that the gains observed in the present study could not have been attributed to the practice effect as the children who were retested post-intervention with a different version of the CELF (different content) also gained in performance. Seven (out of 17) children retested with the CELF-3UK

and all 4 children retested with the CELF-P2 gained in norm-referenced performances at post-intervention test administration (see appendix P).

It can thus be concluded that the observed gains could not have been attributed to the familiarity with the examiner (as all but one child assessed post-intervention by a different speech and language therapist gained in performance) nor to the practice effect (as fewer than half of the children who were retested with a different version of the CELF gained in performance (7 out of 17).

4.3 Chapter Summary

This chapter presented research findings for individual study participants at a case study level. Thirty eight case studies of children from 8 different classes in 5 different DEIS schools, chosen by the criterion of age and the teacher's use of the provided microphone (see chapter three for elaboration), were presented. The intervening factors that were observed to influence language performance of the studied children discussed in this chapter included: teacher-child relationship, time of the observation, familiarity with the lesson content and lesson vocabulary, level of abstraction of the lesson, type of classroom language activity, cognitive demands of the lesson, absenteeism and lateness in school, additional resource hours in school, baseline speech language hearing profile, baseline attention profile and teachers' stimuli.

Case studies of children within individual classes were preceded by narratives aimed at capturing the context of each classroom, including the teacher's teaching style and methodologies, the lesson context, the class and room size, the teacher's use of the provided microphone and the duration of the study. The

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teachers of the observed classes presented different models of teaching with a few teachers creating more traditional Initiation-Response-Feedback models (Sinclair & Coulthard, 1975) in their classrooms (e.g., class F, K and L) and a few teachers creating models of 'guided participation' (Rogoff, 1993) (e.g., class D and N). Most teachers introduced story time as an example of a language lesson.[125] The English curriculum recommends a range of methodologies through which oral language development could be facilitated in infant and junior classes and undertaking story-based activities, along with participation in meaningful conversations and imaginative storytelling, is one of them (IDES, 2005c, p. 14).

Research suggests that there is a tendency for positive correlation between the intervention intensity and the intervention outcomes for children living in areas designated as disadvantaged (see Bryant & Maxwell, 1997, for a review). Intensity of the intervention in the present study could be measured with the frequency the teachers wore the provided microphones. Field notes in relation to the teachers' use of microphones were taken while visiting the schools. There was a variety here with a majority of teachers wearing the microphone *always/most of the time* (64%, 9 out of 14 teachers) and one teacher wearing the microphone *rarely/never* (see case studies of individual classes). It is worth reiterating that video recordings were scheduled in advance.

The process of arriving at the conclusions of this study was a multi-layered one, with analyses conducted at three intersecting levels, namely, at a case study level, a class level and a dimension level. Interpretation of gains was based on a combination of static and dynamic assessments. Following the presentation of findings at a case study level in this chapter, the next chapter presents research

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[125] Story time was given as an example of language lesson to teachers who requested more specification from the researcher as to what was expected from them.