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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CHAPTER FIVE

This chapter presents research findings collated for individual language dimensions and for individual classes of all studied age levels. It consists of two sections. The first section summarises the results for classroom-derived language dimensions and the second section presents the results in relation to norm-referenced language.

Class Level Findings

5.1 Results for Individual Classes and for Individual Language Dimensions

5.1.1 Results for Participation, Responsiveness and Pragmatic Appropriateness

The following tables 6-10 present research findings for samples within individual classes on participation, responsiveness and pragmatic appropriateness dimensions. Data for 14 participating classes are presented for each of these dimensions. Tables 6-9 present results for individual classes while table 10 presents intervention outcomes on participation, responsiveness and pragmatic appropriateness for individual study participants (as presented in the previous chapter). Results for participation dimension are presented in AB design for 9 classes in table 6 and in

ABAB design for 5 classes in table 7.[126] Results for responsiveness and pragmatic appropriateness dimensions are presented in AB design in table 8 and table 9.

[126] The intervention was withdrawn in 5 classes chosen by the criterion of age (the chosen sample for the ABAB design reflected the age of the whole study sample, i.e. there were more junior infant classes and fewer first classes), namely: 2 junior infant classes: class B and E (in which the intervention was introduced at the start of junior infants); 2 senior infant classes: class A (in which the intervention was introduced at the end of junior infants) and class D (in which the intervention was introduced at the start of senior infants); 1 first class: class F (in which the intervention was introduced at the start of first class).

Table 6 *Participation* in AB design (*Par1*) – Performance across the whole study: Baseline (A) and intervention (B) phases for samples within individual classes: Mean raw scores[127]

(Par1)	Number of children	A	B-phase 1	B-phase 2	Findings
		Mean number of recordings =3.5	Mean number of recordings =3.5	Mean number of recordings =3.5	
class C	4	19.32	74.23	51.07	clear gains
class G	4	53.95	27.36	29.43	Decrease
class H	4	54.40	49.90	37.83	Decrease
class J	5	29.39	118.80	76.68	clear gains
class K	5	53.07	67.26	65.12	clear gains
class L	4	26.98	28.85	22.36	no gains
class M	4	28.48	28.33	35.46	gains in last phase
class N	5	42.82	90.78	95.82	clear gains
class O	4	81.18	102.53	119.98	incremental gains
MEAN	**n=39**	**43.29**	**65.34**	**59.31**	**probable gains**

[127] Scoring scale was constructed for the use of the study (0.00=minimum score; no maximum score).

Table 7 *Participation* in ABAB design (*Par2*) - Performance across the whole study: Baseline (A), intervention (B), the withdrawal of intervention (A) and after the return of intervention (B) phases for samples within individual classes: Mean raw scores

(Par2)	Number of children	A Mean number of recordings =3.5	B-phase 1 Mean number of recordings =3.5	B-phase 2 Mean number of recordings =3.5	A Mean number of recordings =2.0	B Mean number of recordings =2.0	Findings
class A	5	9.35	17.48	59.65	19.64	36.88	clear gains in ABAB
class B	6	34.34	37.42	47.89	28.89	40.42	clear gains in ABAB
class D	4	34.24	70.83	69.53	81.35	74.05	clear gains in AB
class E	5	47.22	46.08	73.33	80.00	19.29	no clear AB/ABAB
class F	4	58.95	86.92	145.00	66.84	103.33	clear gains in ABAB
MEAN	**n=24**	**36.82**	**51.75**	**79.08**	**55.34**	**54.79**	**clear AB/not clear ABAB**[128]

[128] The clear ABAB design is 'disturbed' only in the last study phase (after the return of the intervention), which occurred at the end of the school year (in June in a majority of classes).

Table 8 *Responsiveness (Resp)* – Performance across the whole study: Baseline (A) and intervention (B) phases for samples within individual classes: Mean scores (scale 0.00-1.00; score 1.00 = 100%)[129]

(Resp)	Number of children	A Mean number of recordings = 3.5	B-phase 1 Mean number of recordings = 3.5	B-phase 2 Mean number of recordings = 3.5	B-phase 3 Mean number of recordings = 3.5	Findings
class A	5	0.33	0.67	0.71	0.72	clear gains
class B	5	0.87	0.84	0.93		no clear pattern
class C	4	0.62	0.85	0.87		clear gains
class D	3	0.82	0.88	0.91	0.97	clear incremental gains
class E	4	0.73	0.84	0.86	0.86	clear incremental gains
class F	3	0.95	0.95	0.95	0.92	no gains
class G	4	0.67	0.96	0.92		clear gains
class H	4	0.89	0.85	0.99		no clear pattern
class J	4	0.98	0.91	0.96		decrease
class K	3	0.93	0.90	0.72		decrease
class L	4	0.89	0.89	0.84		no gains
class M	4	0.83	0.83	0.90		gains in last phase
class N	5	0.90	0.93	0.94		clear gains
class O	1	0.75	0.57	0.93		no clear pattern
MEAN	**n=53**	**0.80**	**0.85**	**0.89**	**0.87**	**clear gains**

[129] Scoring scale 0.00-1.00 was constructed for the use of the study: 1.00=100% (e.g., 0.15=15%, 0.96=96%).

Table 9 *Pragmatic appropriateness (PragAppr)* – Performance across the whole study: Baseline (A) and intervention (B) phases for samples within individual classes: Mean scores (scale 0.00-1.00; score 1.00 = 100%)

(PragAppr) Number of children		A Mean number of recordings =3.5	B-phase 1 Mean number of recordings =3.5	B-phase 2 Mean number of recordings =3.5	B-phase 3 Mean number of recordings =3.5	Findings
class A	5	1.00	0.97	0.98	0.99	decrease
class B	6	0.93	0.97	0.95		clear gains
class C	4	0.84	0.93	0.94		clear gains
class D	4	0.92	0.91	0.93	0.93	no clear pattern
class E	5	0.90	0.92	0.93	0.95	clear gains
class F	4	0.94	0.96	1.00	1.00	clear incremental gains
class G	4	0.93	0.98	0.98		clear gains
class H	3	0.97	0.98	0.98		no gains
class J	5	1.00	0.97	0.97		decrease
class K	5	1.00	0.96	0.98		decrease
class L	4	0.95	0.97	0.96		no gains
classM	4	0.97	0.97	0.97		no gains
class N	5	0.92	0.98	0.97		clear gains
class O	4	0.96	0.97	0.94		no clear pattern
MEAN	**n=62**	**0.95**	**0.96**	**0.96**	**0.97**	**marginal gains**

Table 10 Responsiveness, Pragmatic appropriateness and Participation: Outcomes for individual study participants (for detailed scores refer to case studies in chapter four and appendix S)
(Blank areas mean that the child's performance was not analysed on a given dimension; each square bracket indicates one class)

Child code and child gender	Responsiveness	Pragmatic appropriateness	Participation
junior infants			
F-B5	no clear pattern	clear gains	no change
F-B3	clear gains	probable gains	probable gains
F-B4		decrease	no clear pattern
M-B1	gains in last phase	clear gains	probable gains
M-B6	gains in last phase	probable gains	small gains
M-B2	clear gains	clear gains	no clear pattern
F-E5	clear gains	clear gains	no clear pattern
M-E1	clear gains	100% throughout the study	no clear pattern
M-E4	decrease	no change	small gains
M-E2	no clear pattern	gains in last phase	probable gains
M-E3		decrease	no clear pattern
F-C3	clear gains	decrease	probable gains
F-C1	clear gains	clear gains	probable gains
F-C4	decrease	probable gains	probable gains
M-C2	clear gains	clear gains	probable gains
F-J4		decrease	probable gains
F-J2	no clear pattern	100% throughout the study	no clear pattern
F-J3	no clear pattern	decrease	probable gains
M-J1	100% throughout the study	100% throughout the study	clear gains
M-J5	decrease	100% throughout the study	no change
M-H4	100% throughout the study	no change	no clear pattern
M-H2	no clear pattern	no clear pattern	no change
M-H1	no clear pattern	probable gains	no change
M-H3	clear gains		no change
F-N5	no clear pattern	clear gains	probable gains
F-N4	clear incremental gains	no change	probable gains
F-N2	clear gains	no clear pattern	probable gains
F-N3	clear gains	clear gains	probable gains
F-N1	no change	clear gains	probable gains
senior infants			
F-L3	decrease	clear gains	no change
F-L4	probable gains	gains in last phase	no clear pattern
F-L1	no clear pattern	decrease	no clear pattern
F-L2	decrease	probable gains	no change
F-A1	probable gains	100% throughout the study	probable gains
F-A2	clear gains	100% throughout the study	probable gains
F-A3	clear gains	no clear pattern	probable gains
M-A4	clear gains	100% throughout the study	no change
M-A5	no change	decrease	no clear pattern

M-D3	clear incremental gains	no clear pattern	no clear pattern
M-D2	probable gains	clear gains	probable gains
M-D4	no clear pattern	no change	probable gains
M-D1		decrease	probable gains
M-M1	gains in last phase	no change	no clear pattern
M-M2	probable gains	decrease	no change
M-M3	decrease	clear gains	no change
M-M4	clear incremental gains	gains in last phase	no change
first classes			
F-F1	100% throughout the study	100% throughout the study	clear gains
M-F3	no clear pattern	clear gains	probable gains
M-F2		gains in last phase	probable gains
M-F4	no clear pattern	clear gains	probable gains
F-O3		no clear pattern	probable gains
F-O2	no clear pattern	no change	no clear pattern
M-O1		no change	no change
M-O4		100% throughout the study	no clear pattern
M-K4	decrease	100% throughout the study	no clear pattern
M-K5		no clear pattern	no change
M-K2	no change	no change	probable gains
M-K3	100% throughout the study	no clear pattern	probable gains
M-K1		100% throughout the study	probable gains
M-G4	probable gains	100% throughout the study	no change
M-G3			
M-G1	100% throughout the study	100% throughout the study	clear gains
M-G2	no clear pattern	clear gains	probable gains

Participation, Responsiveness and Pragmatic Appropriateness

Gains in participation were observed in a majority of classes (9 out of 14 classes), both in AB design (6 out of 9 classes) and in ABAB design (3 out of 5 classes) (Tables 6,7). They were observed in classes of different age level with a majority of them occurring *immediately* after the introduction of intervention and thus exhibiting no incremental pattern.

Responsiveness clearly improved with the introduction of the intervention in half of the participating classes (7 out of 14 classes) (Table 8). The observed gains occurred *immediately* after the introduction of intervention in a majority of these classes and thus exhibited no incremental pattern. No students gained in responsiveness in classes K, O and F, while only 1 student gained in responsiveness in

class G. All of these four classes were first classes. This finding indicates that when it comes to responsiveness, SFA appeared to be more supportive for the younger children.

The observed gains in pragmatic appropriateness occurred *mostly* in junior infant classes (14 children out of 24 who gained in this dimension were junior infants) (Tables 9,10). Six senior infant students (out of 17) showed gains in pragmatic appropriateness (Tables 9,10). There were only 4 (out of 17) first class students who gained in pragmatic appropriateness, three of them from the same class (class F) (Tables 9,10). SFA thus appeared to be more supportive for pragmatic appropriateness of younger children's responses. Pragmatic appropriateness gains for *most* of the observed children occurred *immediately* after the introduction of amplification and thus they did not exhibit incremental pattern.

5.1.2 Results for Loquacity, Syntactic Complexity and Grammatical Correctness

The following tables 11-14 present research findings for samples within individual classes on loquacity, syntactic complexity and grammatical correctness. Tables 11-13 present data for 14 participating classes on each of these dimensions while table 14 presents intervention outcomes for individual study participants.

Table 11 *Loquacity (Loq)* – Performance across the whole study: Baseline (A) and intervention (B) phases for samples within individual classes: Mean scores (scale 0.00-1.00; score 1.00 = 100%)[130]

(Loq)	Number of children	A Mean number of recordings =3.5	B-phase 1 Mean number of recordings =3.5	B-phase 2 Mean number of recordings =3.5	B-phase 3 Mean number of recordings =3.5	Findings
class A	3	0.00	0.02	0.10	0.29	clear incremental gains
class B	4	0.05	0.15	0.19		clear incremental gains
class C	1	0.00	0.00	0.00		no gains
class D	4	0.10	0.12	0.18	0.51	clear incremental gains
class E	4	0.06	0.05	0.21	0.20	gains in 2nd and 3rd phase
class F	3	0.25	0.24	0.22	0.38	gains in last phase
class G	4	0.26	0.27	0.35		clear incremental gains
class H	3	0.10	0.41	0.13		no clear pattern
class J	5	0.06	0.06	0.03		no gains
class K	3	0.22	0.14	0.17		decrease
class L	3	0.21	0.11	0.10		decrease
class M	3	0.17	0.12	0.05		decrease
class N	5	0.30	0.28	0.31		no gains
class O	4	0.26	0.26	0.28		gains in last phase
MEAN	**n=49**	**0.15**	**0.16**	**0.17**	**0.38**	**clear gains**

[130] Scoring scale 0.00-1.00 was constructed for the use of the study: 1.00=100% (e.g., 0.15=15%, 0.96=96%).

Table 12 *Syntactic complexity* (*SynComp*) – Performance across the whole study: Baseline (A) and intervention (B) phases for samples within individual classes: Mean scores (scale 0.00-1.00; score 1.00 = 100%)

(SynComp)	Number of children	A Mean number of recordings =3.5	B-phase 1 Mean number of recordings =3.5	B-phase 2 Mean number of recordings =3.5	B-phase 3 Mean number of recordings =3.5	Findings
class A	3	0.00	0.00	0.02	0.14	gains in 2nd and 3rd phase
class B	4	0.02	0.06	0.11		clear incremental gains
class C	1	0.00	0.00	0.00		no gains
class D	4	0.05	0.09	0.11	0.34	clear incremental gains
class E	4	0.03	0.03	0.09	0.04	no regular pattern
class F	3	0.12	0.09	0.12	0.19	gains in last phase
class G	4	0.00	0.13	0.21		clear incremental gains
class H	3	0.02	0.16	0.08		no clear pattern
class J	5	0.00	0.03	0.00		no clear pattern
class K	3	0.03	0.07	0.00		no clear pattern
class L	3	0.06	0.03	0.00		decrease
classM	3	0.07	0.05	0.02		decrease
class N	5	0.08	0.09	0.16		clear incremental gains
class O	4	0.19	0.10	0.15		decrease
MEAN	**n=49**	**0.05**	**0.07**	**0.08**	**0.18**	**incremental gains**

Table 13 *Grammatical correctness* (*GramCo*) – Performance across the whole study: Baseline (A) and intervention (B) phases for samples within individual classes: Mean scores (scale 0.00-1.00; score 1.00 = 100%)

(GramCo)	Number of.children	A Mean number of recordings =3.5	B-phase 1 Mean number of recordings =3.5	B-phase 2 Mean number of recordings =3.5	B-phase 3 Mean number of recordings =3.5	Findings
class A	5	0.94	0.97	0.93	0.92	not clear pattern
class B	6	0.98	0.90	0.94		decrease
class C	4	0.94	0.96	0.95		no gains
class D	4	0.98	0.90	0.93	0.93	decrease
class E	5	0.92	0.97	0.94	0.88	not clear pattern
class F	4	0.98	0.97	1.00	0.98	not clear pattern
class G	4	1.00	0.94	0.92		decrease
class H	3	0.99	0.98	0.91		decrease
class J	5	0.97	0.97	1.00		gains in last phase
class K	5	1.00	0.97	0.99		decrease
class L	4	0.93	0.99	0.98		clear gains
classM	4	0.99	0.94	0.97		decrease
class N	5	0.90	0.90	0.95		not immediate gains
class O	4	0.96	0.95	0.95		decrease
MEAN	**n=62**	**0.96**	**0.95**	**0.95**	**0.93**	**decrease**

Table 14 Loquacity, Syntactic complexity and Grammatical correctness: Outcomes of individual study participants (for detailed scores refer to appendices M-O)
(Blank areas mean that the child's performance was not analysed on a given dimension; each square bracket indicates one class)

Child code and child gender	Loquacity	Syntactic complexity	Grammatical correctness
junior infants			
F-B5			decrease
F-B3	gains in last phase	gains in last phase	no clear pattern
F-B4			decrease
M-B1	clear gains	clear gains	no change
M-B6	clear gains	gains in last phase	no clear pattern
M-B2	clear incremental gains	clear incremental gains	no change
F-E5			decrease
M-E1	no change	no change	100% throughout the study
M-E4	no clear pattern	no clear pattern	no change
M-E2	not immediate gains	not immediate gains	probable gains
M-E3	clear gains	probable gains	probable gains
F-C3			100% throughout the study
F-C1			clear gains
F-C4	no change	no change	decrease
M-C2			decrease
F-J4	no change	no change	not immediate gains
F-J2	no clear pattern	no clear pattern	no change
F-J3	no change	no change	no clear pattern
M-J1	no change	no change	clear gains
M-J5	no change	no change	100% throughout the study
M-H4	probable gains	gains in last phase	decrease
M-H2	clear gains	probable gains	no clear pattern
M-H1	no clear pattern	no clear pattern	clear gains
M-H3			
F-N5	no clear pattern	no clear pattern	clear incremental gains
F-N4	decrease	clear incremental gains	no clear pattern
F-N2	no clear pattern	probable gains	decrease
F-N3	gains in last phase	gains in last phase	probable gains
F-N1	no clear pattern	gains in last phase	gains in last phase
Senior infants			
F-L3	decrease	no change	clear gains
F-L4	decrease	decrease	gains in last phase
F-L1	gains in last phase	no change	100% throughout the study
F-L2			clear gains
F-A1	gains in last phase	gains in last phase	100% throughout the study
F-A2			no change
F-A3	clear gains	gains in last phase	100% throughout the study
M-A4			clear gains
M-A5	gains in last phase	gains in last phase	decrease

M-D3	probable gains	probable gains	decrease
M-D2	clear gains	clear gains	no change
M-D4	gains in last phase	gains in last phase	no change
M-D1	gains in last phase	gains in last phase	decrease
M-M1	no clear pattern	probable gains	decrease
M-M2			no clear pattern
M-M3	no change	no change	no clear pattern
M-M4	decrease	decrease	decrease
first classes			
F-F1	no clear pattern	no clear pattern	no clear pattern
M-F3	probable gains	probable gains	100% throughout the study
M-F2			100% throughout the study
M-F4	clear gains	no clear pattern	clear gains
F-O3	no clear pattern	decrease	100% throughout the study
F-O2	decrease	decrease	no clear pattern
M-O1	clear gains	clear gains	no clear pattern
M-O4	gains in last phase	no clear pattern	100% throughout the study
M-K4	decrease	decrease	100% throughout the study
M-K5			100% throughout the study
M-K2			no clear pattern
M-K3	decrease	no change	decrease
M-K1	clear gains	no clear pattern	100% throughout the study
M-G4	clear gains	clear gains	100% throughout the study
M-G3	clear gains	clear gains	100% throughout the study
M-G1	clear gains	clear gains	100% throughout the study
M-G2	no gains	no gains	decrease

Loquacity, Syntactic Complexity and Grammatical Correctness

Gains in loquacity were noted in half of the participating classes (7 classes out of 14) and gains in syntactic complexity were noted in fewer than half of the participating classes (6 classes out of 14) (Tables 11,12). Gains in both of these dimensions were noted in classes of different age level. The observed gains in loquacity and syntactic complexity showed mostly either an incremental pattern or were observable towards the end of the intervention, which may suggest some maturation effect (Tables 11,12). Gains in grammatical correctness were noted for only 14 children (22%), nine of them from junior infant classes (Tables 13,14).

5.1.3 Results for Receptive Language, Expressive Language and Receptive Vocabulary

Table 15 below presents pre- and post intervention norm-referenced language profiles for each participating class on the dimensions of receptive language, expressive language and receptive vocabulary. Tables 16-18 that follow present pre- and post-intervention norm-referenced language profiles for individual study participants.

Table 15 Differences between post-intervention (B) and pre-intervention (A) mean standardised score results for samples within individual classes: *Receptive language*, *Expressive language* and *Receptive vocabulary* (figures represent calculated differences B-A)

Receptive language

Class code	G	M	O	C	A	K	D	H
Difference (B-A)	+2,00	-5,75	+6,28	+3,20	+8,00	+3,67	+8,50	0,00

Expressive language

Class code	M	L	C	J	B	F	K	D	H	E
Difference (B-A)	-1,25	+4,00	-4,25	+2,60	+1,60	-7,60	-2,67	-1,00	+2,25	+3,40

Receptive vocabulary

Class code	N	L	J	B	F	H	E
Difference (B-A)	-3.40	-1,25	+5,60	+2,20	-6,40	+4,00	+1,40

Table 16 *Receptive language* – Performances of each study participant pre-intervention and post-intervention (n=number of children assessed, SS=norm-referenced standardised score)
(One square bracket indicates one class; 'Large gain' was assumed with the increase of 8 or more standardised scores (approximately two 68% confidence intervals, see chapter three)

Child code	Receptive language	Receptive language	Findings
n=57	pre-intervention	post-intervention	
Junior infants	**SS**	**SS**	
M-C2	69	77	large gain
F-C1	80	85	gain
F-C4	84	71	decrease
F-C5	73	76	gain
M-H2	112	113	no change
M-H4	108	91	decrease
M-H5	64	67	gain
M-H1	73	76	gain
Senior infants			
M-M4	76	74	decrease
M-M1	76	77	no change
M-M2	67	64	decrease
M-M3	93	74	decrease
M-D4	73	80	gain
M-D3	64	74	large gain
M-D2	88	90	gain
M-D1	73	74	no change
F-A1	101	125	large gain
M-A5	64	67	gain
F-A2	91	99	large gain
F-A3	125	128	gain
M-A4	77	74	decrease
First classes			
M-K4	90	86	decrease
M-K1	99	109	large gain
M-K2	67	95	large gain
M-K5	67	65	decrease
M-K3	93	98	gain
M-G5	64	66	gain
M-G4	92	73	decrease
M-G3	74	89	large gain
M-G2	74	66	decrease
M-G1	74	94	large gain

F-O3	72	81	large gain
M-O4	83	95	large gain
F-O2	72	81	large gain
M-O8	84	83	no change
M-O7	74	83	large gain
M-O1	67	74	gain
M-O6	93	92	no change
MEAN	**81**	**84**	**gain**

Table 17 Expressive language – Performances of each study participant pre-intervention and post-intervention (n=number of children assessed, SS=norm-referenced standardised score)
(One square bracket indicates one class); 'Large gain' was assumed with the increase of 8 or more standardised scores (approximately two 68% confidence intervals, see chapter two)

Child code	Expressive language	Expressive language	Findings
n=59	pre-intervention	post-intervention	
Junior infants	**SS**	**SS**	
M-B1	100	94	decrease
M-B2	94	98	gain
F-B4	79	91	large gain
F-B5	66	70	gain
M-E4	86	105	large gain
M-E3	84	87	gain
M-E2	87	94	**gain**
M-E1	91	85	decrease
F-E5	70	64	decrease
M-H2	116	106	decrease
M-H4	96	89	decrease
M-H5	73	85	large gain
M-H1	82	96	large gain
F-J2	88	101	large gain
F-J4	76	70	decrease
M-J5	73	70	decrease
M-J1	87	91	gain
F-J3	89	94	gain
M-C2	87	70	decrease
F-C1	73	70	decrease
F-C4	64	64	no change
F-C5	75	78	**gain**

Senior infants			
M-M2	78	69	decrease
M-M1	80	81	no change
M-M4	64	69	no change
M-M3	71	69	decrease
M-D4	75	74	no change
M-D3	70	69	no change
M-D2	77	83	gain
M-D1	77	76	no change
F-L4	73	92	large gain
F-L1	73	74	no change
F-L2	84	82	decrease
F-L3	92	90	decrease
First classes			
M-K4	99	90	decrease
M-K1	92	106	gain
M-K2	64	65	no change
M-K5	64	73	gain
M-K3	78	65	decrease
M-F2	85	77	decrease
F-F1	86	84	decrease
M-F5	97	83	decrease
M-F4	74	69	decrease
M-F3	75	66	decrease
MEAN	**81**	**81**	**no change**

Table 18 Receptive vocabulary – Performances of each study participant pre-intervention and post-intervention (n=number of children assessed, SS=norm-referenced standardised score)
(One square bracket indicates one class)

Child code	Receptive vocabulary	Receptive vocabulary	Findings
n=61	pre-intervention	post-intervention	
Junior infants	**SS**	**SS**	
F-B5	93	86	decrease
M-B2	101	104	gain
F-B4	94	92	decrease
M-B1	99	108	large gain
M-B3	90	98	large gain
M-E2	90	97	gain
M-E4	96	92	decrease
M-E3	101	102	no change
F-E5	85	84	no change
M-E1	93	97	gain
F-N3	91	88	decrease

F-N4	90	86	decrease
F-N1	92	93	no change
F-N2	101	102	no change
F-N5	99	87	decrease
M-H4	101	119	large gain
M-H2	111	117	gain
M-H5	97	83	decrease
M-H1	95	101	gain
F-J2	101	112	large gain
F-J4	95	95	no change
M-J5	86	92	gain
M-J1	90	101	large gain
F-J3	99	99	no change
Senior infants			
M-D3	85	74	decrease
F-L4	96	93	decrease
F-L1	87	89	gain
F-L2	89	83	decrease
F-L3	99	101	gain
First classes			
M-F4	90	88	decrease
M-F2	106	103	decrease
M-F5	106	85	decrease
F-F1	91	91	no change
M-F3	89	83	decrease
MEAN	**95**	**95**	**no change**

Receptive Language, Expressive Language and Receptive Vocabulary

Most tested classes (6 out of 8) - or a majority of tested children when individual profiles are analysed (19 children out of 33 participants, 58%) - showed gains in norm-referenced performance in receptive language (Tables 15,16). There was only one class in which *all* students deteriorated in post-intervention norm-referenced performance in this dimension (class M-senior infants) (Table 15). Gains in receptive language were noted in classes of different age level, mostly for students in classes C-junior infants, A-senior infants, D-senior infants, O-first class, G-first class and K-first class.

Half of the tested classes (5 out of 10 classes) - or a small majority of tested participants when individual profiles are analysed (14 out of 27 participants, 52%) - gained in norm-referenced expressive language, mostly students from classes J-junior infants, B-junior infants, H-junior infants and E-junior infants (Tables 15,17). Thus, it can be concluded that gains in expressive language were noted *mostly for junior infants.*

A small majority of tested classes (4 out of 7 classes) – however, fewer than half of tested participants when individual profiles are analysed (13 out of 31 participants; 41%) - gained in receptive vocabulary (Tables 15,18). Gains in receptive vocabulary were noted in classes in 4 different schools but only in junior infant classes (mostly for students from classes J-junior infants, B-junior infants and H-junior infants). While four classes gained in post-intervention performance on receptive vocabulary, almost all students from class N-junior infants and class F-first class deteriorated in performance on this dimension.

Overall, norm-referenced gains in receptive language were greater than gains in expressive language and receptive vocabulary. This conclusion is strengthen by the fact that 3 classes out of 6 that gained in receptive language gained by 5 or more standardised points, while no classes assessed on expressive language gained by 5 or more standardised points and only 1 class assessed on receptive vocabulary gained by more than 5 standardised points. All class levels gained in *receptive language* but *only* junior infant classes gained in *receptive vocabulary* and *mostly* junior infants gained in *expressive language.* It must be emphasised that these performances were norm-referenced and thus the gains made by junior infants could not have been attributed to a developmental effect.

5.1.4 Summary of Class Level Findings

The class level findings presented in this chapter indicated that a majority of classes across all grade levels showed gains in two studied language dimensions, namely classroom participation and norm-referenced receptive language. The performance on the other dimensions was variable for different classes, with the least amount of gains recorded in grammatical correctness. While SFA was found to support the participation and receptive language of children of all grade levels, the gains in responsiveness, pragmatic appropriateness, norm-referenced expressive language and norm-referenced receptive vocabulary were more likely to occur in junior infant classes. It must be emphasised that gains made on the latter two dimensions, namely expressive language and receptive vocabulary, were *not* developmental but norm- referenced.

A crucial observation made at a class level analysis was that gains both within dimensions and across dimensions tended to be observable especially in some classes, in particular in four classes (classes A, B, C and D). This observation was indicated by square brackets in tables 10, 14 and 16-18. The observed 'class effect' suggests that certain conditions in these classes maximised the efficacy of the studied intervention. As class profiles presented in the previous chapter indicate, common distinctive features of these four classes relate to the quality of language teaching and the size of the classroom (see chapter six for elaboration).

Gains in participation, responsiveness and pragmatic appropriateness occurred immediately after the installation of SFA, indicating that this intervention readily supported children's performance in these dimensions. Gains in loquacity and syntactic complexity showed either mostly an incremental pattern or were observable towards the end of the intervention, which may suggest some maturation effect.

5.2 Conclusion

A number of themes emerged as the research findings were classified. In addition to findings for individual study participants presented in chapter four, this chapter presented findings for individual language dimensions and for individual classes, with grade level creating an additional layer of analysis within this classification. Two observations can be made on the basis of a class level analysis presented in this chapter. Firstly, the data presented in tables 6-18 show that the gains within individual language dimensions were clearly observable within the same classes (these classes are indicated by square brackets in the tables). Common distinctive factors observed in these classes will be discussed in the next chapter.

Another observation made at a cluster level analysis was that the intervention outcome for the whole sample (indicated in each dimension by a mean score) was positive for 6 out of 9 studied dimensions, including 5 of the 6 dimensions studied in the classroom context (Tables 6,7,8,9,11,12,13,16,17,18). One could thus conclude on the basis of the mean scores for the whole sample that SFA substantially benefited language performance of the studied children. Such a cluster approach, adopted by most previous SFA researchers, ignores, however, the more complex picture of the efficacy of this intervention, revealed at analyses of individual classes and individual children within them (see chapter four), and discussed in further detail in the next chapter. One may thus conclude that the comparison of case study and cluster approaches showed in this study revealed the limitations of previous SFA evaluations that adopted predominantly cluster analyses to arrive at their conclusions.

Key findings interpreted within a systems theory perspective will be further discussed in the next chapter.

CHAPTER SIX

Summary of Key Findings and Implications for Policy and Practice

This chapter consists of four sections. The first section summarises key findings of the study. The implications for further research and theory, and for policy and practice are discussed in sections two and three, respectively. This is followed by the conclusion of the study in section four.

6.1 Summary of Key Findings

The findings of this study can be classified according to a number of themes. Firstly, they can be classified in terms of class level of the participants, i.e. in terms of SFA benefits observed in junior infants, senior infants and first classes. Secondly, they can be categorised in terms of SFA benefits for children with specific characteristics, including children with teacher-attributed attention difficulties, children with baseline language abilities indicative of a language delay/disorder[131], children for whom English was an additional language (EAL) and children who presented with speech difficulties at baseline. Thirdly, the

[131] As assessed by standardised tests. The term, 'delayed language' is commonly used by speech and language therapists to refer to persons whose speech and language profile is below the one indicated by the standardised tests' norms (i.e. <85SS). The term 'language impairment/disorder' is routinely used by speech and language therapists to refer to speech and language performance that is more than one standard deviation below the norm.

findings can be categorised in terms of gains in individual language dimensions, with norm-referenced versus classroom-derived language gains within this categorization. Finally, class level analysis (i.e. findings for individual classes), in addition to analyses for specific target groups and for individual dimensions, presents an additional theme. The following accounts will summarise and discuss research findings categorised according to the above themes.

6.1.1 Larger Gains for Junior Infant Pupils than for Other Class Groups

Fifty eight per cent of junior infant pupils gained in pragmatic appropriateness (14 out of 24[132]), meaning that these children began producing more pragmatically appropriate and adequate contributions after the intervention was introduced. Gains in pragmatic appropriateness were noted for only 6 senior infant pupils (out of 14) and for only 4 first class pupils (out of 10). It must be noted, however, that there was a higher proportion of pupils in first classes (but not in senior infants) whose every contribution was pragmatically appropriate and adequate throughout the study. Thus, one must recognise that there was a lesser scope for improvement in this dimension for first class pupils.

Norm-referenced gains in expressive language were noted mostly in junior infant classes, namely 12 of the 17 children who showed gains in this dimension post-intervention were junior infants. Furthermore, all but one pupil who made *large* gains in this dimension (i.e. gains by 8 or more SS[133]) came from junior infant classes (there were 6 of these students, five of them from junior infants). Additionally, mostly junior infant pupils gained in receptive vocabulary, i.e.

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[132] The total number of participants in all age groups analysed for gains in pragmatic appropriateness does *not* include the pupils whose pragmatic appropriateness score remained 100% throughout the study.

[133] Approximately 2 standard deviations

there were 11 junior infant pupils, two senior infant pupils and no first class pupils who gained in this dimension. While there were only 5 senior infant pupils and 5 first class pupils assessed in norm-referenced receptive vocabulary, three out of 5 pupils from senior infant classes and 4 out of 5 pupils from first classes actually deteriorated in performance on this dimension. Vocabulary is a non-contrasted feature of language (Seymour et al., 1998), i.e. a feature that is most likely to differ among individuals and populations, with this difference widening with age. Children in junior infant classes learn many basic linguistic concepts, which are shared among different varieties of language. One can thus conclude that when it comes to vocabulary, SFA is likely to make a greater impact for younger children.

Gains in grammatical correctness occurred most often in junior infant classes. Out of 14 participating children who showed gains in this dimension post-intervention, nine were junior infant pupils. As gains in this dimension were observed rather towards the end of the intervention phase, one might conclude that they might have been partly attributable to the maturation effect. However, as no gains/no clear pattern/decreased outcomes in relation to grammatical correctness were noted in the remaining classes, it can be concluded that the intervention was likely to support the development in this dimension for those pupils who showed gains. It is important to recognise that speech difficulties experienced by 2 pupils from junior infant classes (i.e. child H1 and child B5) were observed to lower their baseline scores in grammatical correctness and expressive language. Gains in these two language dimensions made by these two participants were clearly attributable to improved speech at the end of the study. Speech is closely related to language grammar and it may affect the scores on

word knowledge. For instance, if a child deletes final consonants in words, the expressions of plural and possessive noun forms are also affected. It is possible that SFA supported speech development for these two children as their teachers reported that they were not aware of any speech therapy the participating children received during the study.

Thus, junior infant pupils were more likely than the older study participants to show gains in the dimensions of pragmatic appropriates of utterances, grammatical correctness of utterances, expressive language and receptive vocabulary. This trend was not noted for the other language dimensions. A majority of junior infant pupils showed gains in norm-referenced receptive language (5 out of 8 junior infant students tested on this dimension; 63%); however, this was the case for all age groups. The performance on responsiveness, participation, loquacity and syntactic complexity was variable. Thirteen junior infant pupils (46%) showed gains in responsiveness, with 10 pupils making clear gains in responsiveness and 3 pupils making probable[134] gains in responsiveness. There was only one junior infant pupil who showed clear gains in participation; however, as many as 12 pupils showed possible gains in this dimension (45%). Performance on participation was observed to be strongly dependable on the lesson content (see chapter four for elaboration on contextual factors affecting language performance in the classroom). Seven junior infant pupils showed gains in both participation and responsiveness dimensions.

Ten junior infant pupils out of 22 (45%) showed gains in loquacity and eleven junior infant pupils showed gains in syntactic complexity (50%). Nine of

[134] See chapter three for a definition of 'probable gains' versus 'clear gains'.

these students showed gains in both of these dimensions. It must be noted, however, that baseline loquacity and syntactic complexity scores could not be established for seven children from junior infant classes, due to insufficient baseline language samples recorded for these children. Consequently, the performance of these seven children on these two language dimensions was not analysed.

It must be emphasised that gains made on three dimensions, namely receptive language, expressive language and receptive vocabulary, were *not* developmental but norm- referenced. One cannot attribute any norm-referenced gains to maturation. It can thus be concluded from the summary of findings presented above that the intervention benefited younger study participants to a greater extent than it benefited the older pupils, a hypothesis supported by many previous intervention studies (see, e.g., Bryant & Maxwell, 1997, for a review). This conclusion is based on the analysis of findings from four language dimensions, two observed in the classroom and two measured in a norm-referenced comparison, namely grammatical correctness, pragmatic appropriateness, expressive language and receptive vocabulary.

Three factors must be discussed when analysing the finding that gains were larger in classes in which SFA was installed at the start of junior infant year. These relate to the neuromaturation of the auditory system, classroom noise levels and the schooling effect. Firstly, children younger than 5 years of age are likely to have less mature listening skills due to an unfinished process of neuromaturation of the auditory system than the older pupils from senior infants and first classes (Gil-Loyzaga, 2005; Moore, 2002). More complex cortical processing of auditory stimuli that allows for greater speech perception in noise

is formed during later childhood identified as occurring between 5-12 years of age (Moore, 2002). Secondly, noise levels are likely to be higher in junior infant classes, partly due to the use of more active teaching methodologies. One can thus predict that an improved signal-to-noise ratio (SNR) is likely to bring benefits to language learning in particular in classrooms with poorer listening conditions (e.g., with more internal noise generated).

Thirdly, it is now generally recognised that socio-economically disadvantaged children are more dependent on a *good quality* early education setting in their development than their more advantaged peers (McGough, 2007). One might argue that the results of this study partly reflect the impact of the first year of schooling on the development of these children. This hypothesis would imply that children living in areas of socio-economic disadvantage improve their language performance in comparison to norms for age in their first year of schooling. Interestingly, the results of meta-analysis of intervention studies for socio-economically disadvantaged children conducted by Bryan & Maxwell (1997) show progressive deterioration in performance with age for children who do not receive interventions (i.e. for control groups of intervention studies)[135] (Bryant & Maxwell, 1997). It is not known, however, whether this is true specifically in relation to the first year of schooling and whether this is true specifically to language performance, as the intervention programmes analysed by Bryant & Maxwell (1997) target various aspects of development and behaviour, and a variety of age groups. Furthermore, it is important to recognise that norm-referenced gains were *not* noted in one junior infant class (class N)

[135] The meta-analysis included both centre-based, home-based and combination programmes designed for children of different ages (Bryant & Maxwell, 1997, p. 24). No meta-analyses of interventions focused specifically on language development of children from areas of socio-economic disadvantage were found.

whose teacher was observed to wear the provided microphone *occasionally/sometimes.* The possible necessity of a long-term exposure to SFA as a factor supporting the occurrence of *norm-standardised* language gains will be discussed later in this chapter.

To summarise, there were two language dimensions in which a majority of junior infant pupils showed gains, namely receptive language and pragmatic appropriateness, while the profiles on other language dimensions were variable. Junior infant pupils from all junior infant classes made some gains. In other words, there was no junior infant class in which pupils made no gains or in which marked deterioration of performance on any specific language dimension was noted - two observations that *were* made in older classes. Students from two junior infant classes (i.e. class B and C) made larger gains than students from the other junior infant classes (see below in this chapter for elaboration on class effect). Individual characteristics of participants such as attention difficulties or baseline language ability were associated with the occurrence of gains (this will be discussed in the paragraphs below).

6.1.2 Class Effect Impacting on Gains in Senior Infants and First Classes

Senior infants

A majority of pupils in senior infant classes gained in loquacity, syntactic complexity, receptive language and responsiveness, while the profile shown on other language dimensions was variable. Eight senior infant pupils gained in loquacity and eight senior infant pupils gained in syntactic complexity. This constituted a majority (62%; 13 senior infant pupils were tested on each of these dimensions). Gains in these two dimensions tended to occur together, i.e. seven

children gained in both of these dimensions. Ten senior infant pupils out of 16 showed gains in responsiveness (63%). There were 3 senior infant classes studied on norm-referenced receptive language. Seven pupils out of 13 pupils assessed from these three classes showed gains in receptive language. This represents a small majority.

Gains in the remaining language dimensions, namely pragmatic appropriateness, participation, expressive language, receptive vocabulary and grammatical correctness, were not made by a majority of senior infants. Six senior infant pupils showed gains in pragmatic appropriateness (31%). Gains in participation were noted also for six senior infant pupils (out of 17 pupils from 4 senior infant classes participating in the study). Only 3 pupils from 3 different senior infant classes studied on norm-referenced expressive language gained in this dimension. These three pupils were not found to share any common characteristics in terms of the baseline profile. No senior infant classes showed gains in grammatical correctness.

While the performance on different language dimensions was strongly variable for senior infants as a group, it was observed that *a majority* of the pupils from classes A and D showed gains in *a majority* of the studied language dimensions, while pupils in class M showed fewest gains and pupils in class L showed some gains but these could not be attributed to the intervention in two cases.[136] It can thus be concluded that a class effect was observed in the data of this study. This observation is discussed later on in this chapter.

[136] Classroom-based intervening factors for these two children included the lesson content, the teacher attention and the time of the year (see case studies of children L1 and L2 in chapter four). Contextual factors affecting language performance in the classroom are discussed in detail in chapter four. Gains were not attributed to the intervention for a child D3 who received intensive daily in-school support for a period of time during the intervention phase (see case study of child D3 in chapter four).

First classes

Similarly to the other age groups, a majority of first class pupils were observed to show gains in norm-referenced receptive language (11 out of 17; 65%). Interestingly, *all* children from class O gained in this dimension. Eight out of 14 first class pupils (57%) gained in loquacity while 5 out of 14 first class pupils (36%) gained in syntactic complexity (4 pupils gained in both of these dimensions). Two pupils from the same first class showed gains in norm-referenced expressive language, while no pupils showed gains in the other first class in which this dimension was assessed.

There was only one first class pupil who showed gains in grammatical correctness and only one first class pupil (a different pupil) who gained in responsiveness. Class level analysis presented in chapter five revealed that no first classes gained in responsiveness while the general outcome for the sample was one of a gain. However, it must be noted that responsiveness remained 100% throughout the study for 7 first class pupils (41%). One may thus hypothesise that responsiveness is a lesser problem in the older classes than it is in the younger classes. Four first class pupils out of 17 showed gains in pragmatic appropriateness (24%). Interestingly, all of them were from class F (there were 5 study participants in class F). Clear gains in participation for first class pupils were noted for only 1 pupil, while 9 other pupils showed probable gains. To conclude, while there were in general fewer gains recorded for pupils from first classes than for pupils from infant classes, some-evidence of class effect in first classes was also observable.

6.1.3 Gains for Children with Teacher-attributed Attention Difficulties

Children who were identified by their teachers as experiencing attention difficulties at baseline showed a tendency to derive greater benefits from the intervention than the other study participants. This conclusion is based on the following observations. In the classes in which the outcomes of the intervention varied (i.e. some children showed gains and some children did not), it was *mostly* the children with teacher-attributed attention difficulties that showed gains. This was observed, for example, in class C-junior infants where 3 study participants with teacher-attributed attention difficulties showed clear gains in both static and dynamic assessments (i.e. children C1, C2 and C3), while two other participants without attributed attention difficulties did not show gains in a majority of dimensions (i.e. children C4 and C5).

Furthermore, in classes J-junior infants and F-first class the *only* participants who showed gains in a majority of the studied dimensions were those who were identified by the teachers as experiencing attention difficulties (i.e. children J1, F3 and F4). Overall, there were 20 children with teacher-attributed attention difficulties from all class-level groups. This represented 31% of the whole sample. As many as 13 these children (65%) showed language gains in more than half of the studied dimensions. This is an interesting finding as a linguistic profile of each participant was based on as many as 8 language dimensions and there were only 24 participants in the whole sample (37%) who showed gains in more than half of the studied dimensions.

Interestingly, children with teacher-attributed attention difficulties who did *not* gain in norm-referenced language were more likely to deteriorate in language performance than children without teacher-attributed attention

difficulties who did not gain from the intervention. While most of the children with teacher-attributed attention difficulties showed gains in receptive language, deterioration in performance was observed for all but one of the remaining pupils who did not show gains (i.e. 4 out of 5 pupils). In general, however, a deterioration of norm-referenced language performance, particularly in expressive language and receptive vocabulary dimensions, was observed in many of the classes where no gain outcomes were noted. It was found that 20 out of 27 children who did not gain in norm-referenced expressive language deteriorated in performance, and that while half of the participating classes gained in norm-referenced receptive vocabulary, the other half deteriorated in performance.

6.1.4 Gains for Children with Baseline Language Delay/Impairment

A large majority of pupils who presented with a language delay/impairment at the baseline gained in norm-referenced receptive language (65%), with many of them (36%) making large gains. This was true also for the pupils whose baseline receptive language abilities were 2 or more standard deviations below the mean as 7 out of 9 such pupils showed gains in this dimension. In general, a large majority of children who gained in norm-referenced receptive language were children whose baseline abilities were indicative of a language delay/impairment, with fewer than half of them having had been *additionally* considered by their teachers to have attention difficulties at baseline. Only 5 children out of 25 whose baseline profile indicated a language delay/impairment gained in norm-referenced *expressive* language. The majority of them, however, made large gains.

The finding that children with weaker language skills showed greater gains in receptive language indicates that what is often termed the Matthew effect (Merton, 1968)[137] was *not* observed in relation to norm-referenced receptive language performance. In contrast, the results suggest that the intervention clearly supported language development for the majority of children who performed below the normative range in this dimension at the baseline assessment.[138] It must be noted, however, that the post-intervention performance of most of these children was still indicative of a language delay/impairment. In other words, the gains made were insufficient 'to remedy' the potential language delay/impairment. This highlights the somewhat obvious fact that SFA cannot replace speech and language therapy required by children with language impairments. However, it can clearly support these children's comprehension in the classroom.

The Matthew effect - not present in relation to norm-referenced receptive language - was, however, observable in classroom performance. In other words, children who contributed to the classroom discourse more often and with longer and more complex sentences pre-intervention were more likely to improve further under the amplified conditions. On the other hand, children who contributed at baseline less frequently and with shorter and less complex responses were less likely to improve their classroom language performance under the amplified conditions. In general, pupils with stronger speech and language skills pre-intervention showed more *classroom* gains than pupils with weaker baseline language skills. Furthermore, six children with a norm-

[137] The Matthew effect is a phenomenon of so called 'accumulated advantage', i.e. in relation to intervention studies, it relates to a situation in which research participants with stronger/higher baselines derive greater benefits from the intervention than those with weaker/lower baselines.
[138] Some tendency for the Matthew effect was observed in relation to norm-referenced receptive vocabulary.

referenced language delay at the baseline, who showed norm-referenced gains post-intervention, were not observed to show simultaneously large gains in classroom language performance. Interestingly, this was the case mostly for children from first classes (i.e. three children in class O-first class and two children in class K-first class, as well as child C4 from junior infant class).

Three possible explanations of these findings arise. Firstly, these findings may be interpreted in the context of teacher expectations. It has been recognised by educational researchers that children who are considered by their teachers to have language difficulties receive fewer open-ended questions, resulting in fewer clausal utterances produced and ultimately fewer opportunities for elaborated responses (Hargreaves, 1984). Secondly, one must remember that standardised language gains were noted mostly in receptive language. Language dimensions observed in the classroom relate mostly to expressive language, as it is very difficult, if not impossible, to assess comprehension in a dynamic context, without norm-referenced instruments.

Thirdly, speech difficulties affected some children's performance in the classroom. Speech difficulties do not usually affect the results of standardised tests of comprehension as receptive language assessment relies on non-verbal responses. Speech difficulties observed at baseline were found to be a major intervening factor in the occurrence of language gains. For instance, child F-C4 had severe speech disorder pre-intervention, which was still present post-intervention (she covered her mouth when asked to contribute as if she was aware of her difficulty). She was observed to benefit much less from the intervention than the other children in her class.

6.1.5 Variable Gains for Children for whom English was an Additional Language

There were only six EAL children from 4 different classes in the study sample (i.e. children D1, D2, K2, K5, A5 and H3). *Responsiveness* of two of them (i.e. child H3 and D2) showed very clear large gains after SFA installation. Three EAL children showed gains in norm-referenced language. However, only one of these three children showed gains also in the classroom (child D2). Child D1 (from the same class as child D2) showed gains in classroom performance but did not show gains in norm-standardised language, while child K5 showed gains only in norm-standardised performance but no gains in the classroom. It can thus be concluded that children for whom English was an additional language showed variable intervention outcomes.

It must be emphasised that firstly the number of EAL children was very small in the studied sample to allow for any general conclusions, and secondly that these children came from only 4 classrooms. Two of these children came from a first class (class K) in which in general fewer gains were noted. In contrast, child D2, from a senior infants class in which a majority of participants showed gains in a majority of language dimensions, showed clear gains both in norm-referenced language and in classroom-derived dimensions. Child H3 from a junior infant class showed very clear gains in responsiveness.[139] These observations show clearly that the benefits of the studied intervention for EAL children are not 'a given', as it was indicated almost uniformly in previous SFA literature (Crandell, 1996; Massie & Dillon, 2006a). The SFA effect for these children is potentially mediated by classroom factors, such as the teaching

[139] Language performance of this child was observed on only two dimensions, namely responsiveness and pragmatic appropriateness (see case study of child H3 in chapter four).

quality and the age of the class. Classroom factors that were observed to mediate the effect of SFA will be discussed later on in this chapter. The EAL group in the current study was small and diverse. Due to its heterogeneity, the initial finding of variable gains for EAL children in this study needs a further exploration.

6.1.6 Speech Problems as a Factor Hindering the Occurrence of Language Gains

A general trend was noted whereby children with baseline speech and/or fluency difficulties, in addition to baseline language difficulties, who presented with broadly the same speech and/or fluency difficulties post-intervention, did not show large language gains, while the other study participants from their classes did. This was observed, for instance, in class E (child E4) and class C (child C4). However, children who presented with baseline speech difficulties but whose speech *improved* during the study showed some gains, particularly in those dimensions mostly inter-related with speech performance (i.e., expressive language and grammatical correctness).

Child B5, for instance, presented with fewer speech difficulties at the post-intervention standardised assessment and was observed to show gains in pragmatic appropriateness and expressive language dimensions. She, however, showed fewer gains on the other language dimensions than her classroom peers who did not present with speech difficulties at baseline. Child H1 who presented with speech difficulties at baseline, but whose speech improved during the study, showed gains in grammatical correctness as well as norm-standardised expressive language and receptive vocabulary. While no study participants were

reported to have received SLT services during the study, it is possible to hypothesise that SFA might have contributed to improved phonological development for some of the children whose speech improved over the course of the study. Speech was, however, not the focus of this study and thus it is not possible to explain why some children's speech improved during the study, while the speech of the others did not do so.

6.1.7 Clear Gains in Responsiveness for Children with Potential Hearing Difficulties

The responsiveness of children with *potential* hearing difficulties clearly improved after SFA installation. This was the case for child E2 whose responsiveness under the amplified classroom conditions hugely improved, as shown by a very clear ABAB pattern. This child was reported by his teacher to have hearing difficulties (Teacher*: It is obvious that he has hearing problems/the way he tilts his head*). However, at the time of this research, he awaited audiological diagnosis of these difficulties. Another child from class A (child A2) showed a very clear ABAB pattern in responsiveness. She was not suspected by her class teacher to have hearing difficulties.

6.1.8 Class Level Analysis: SFA Contributed Mostly to Gains in Comprehension and Participation

As evidenced in tables 6-18 presented in the previous chapter, overall, largest gains were noted in norm-referenced receptive language. Most of the observed classes gained in this dimension (6 out of 8 classes tested), regardless of the average age and the gender of the class. A majority of participating classes

showed gains in norm-referenced receptive vocabulary (4 out of 7 classes tested on this dimension). A majority of the observed classes showed either clear or probable gains in participation (9 out of 14 classes observed on this dimension), meaning that more children volunteered to contribute to the classroom discussion under improved listening conditions. It can thus be concluded that, at a class level, the classroom amplification system contributed mostly to gains in children's comprehension (i.e. receptive language and receptive vocabulary) and classroom participation.

While class level was found to be a factor impacting on the observed gains on four of the studied dimensions (i.e. expressive language, receptive vocabulary, pragmatic appropriateness and grammatical correctness), gender was in general found to be of no significance for most language dimensions except receptive vocabulary. It was observed that boys were more likely to gain in receptive vocabulary than girls. In the contexts of this finding, it is crucial to recognise that boys are much more likely to experience attention difficulties as the ratio of boys with diagnosed ADHD to girls diagnosed with ADHD is thought to be 4:1 (Lahey et al., 1994; Sandberg, 2002; Timimi et al., 2004). In this study, there were 6 female pupils and 14 male pupils identified by their teachers as experiencing attention difficulties, in comparison to 26 female pupils and 39 male pupils participating in the study.

Half of the observed classes gained in responsiveness (7 out of 14 classes), i.e. the children in these classes responded to more teacher obligations after the amplification of the teacher's voice. Furthermore, half of the observed classes gained in loquacity (7 out of 14 classes), half gained in expressive language (5 out of 10 classes tested on this dimension) and fewer than half gained in

syntactic complexity and pragmatic appropriateness (6 out of 14 classes). However, the majority of gains in loquacity and syntactic complexity were not immediate, i.e. they either displayed an incremental pattern or were present in the final phases of the study. Gains in grammatical correctness were observed in only two classes, both of them junior infants.

It is recognised in this thesis that a range of conditions need to be met for language development to take place, with an improved hearing canal being only a one single contributor. This recognition is particularly relevant to some more structural language dimensions, such as syntactic complexity and loquacity, as well as grammatical correctness, which may need a more targeted intervention in order to show larger improvements. While it is recognised that SFA may be limited in its more direct impact on expressive language, the results of this study suggest that SFA has a clear potential to aid the growth of the comprehension in the classroom. In the SLT field, there are not many language interventions that were found to be beneficial for receptive language and not many language interventions that actually target receptive language (Law et al., 2004). The results of a meta-analysis of interventions for children with primary developmental speech and language delays/disorders show also little evidence of speech and language therapy effectiveness for children with receptive language difficulties (Law et al., 2004). It is possible, however, that greater gains for receptive language than for expressive language observed in this study could be also due to a relatively short period of the intervention, which was insufficient to impact greater on expressive language. Expressive language, as noted by Reid et al. (2004), in general tends to be weaker than receptive language.

When discussing the relative absence of gains in expressive language, it is important to consider potential linguistic biases of standardised tests used for the assessment of expressive language, a language modality that is usually considered to be more susceptible to linguistic biases in a static assessment than receptive language (Fujiki & Brinton, 1987; Prutting & Connolly, 1976; Scott, 1988). The Formulating Labels subtest, which is a component of an expressive language standardised test used in this study, and assesses expressive vocabulary, is an open format test and thus it may be less linguistically biased (Gray et al., 1999). Interestingly, clearer gains were noted on this subtest than on any other subtests of expressive language. Furthermore, some reticent children might have felt 'threatened' when required to provide many verbal responses during testing. For such children, the performance on receptive language tests, during which children 'only' point to pictures could be more reliable. However, it is possible that the relative absence of gains in expressive language reflects the 'weaknesses' of SFA as an educational intervention that does not target any specific language areas but the listening channel.

6.1.9 Greater Gains in One Geographical Location: The Effect of a Macro-system?

The study was conducted in two different geographical locations. Four schools were in the Dublin Ballyfermot area and 3 schools in the inner city area.[140] The geographical location of the school was found to have some impact on the results of the study. In other words, more norm-referenced gains were made by classes from the Ballyfermot area than by classes from the inner city.

[140] Classes in Dublin Ballyfermot were: A, B, C, E, F, J, L and O. Classes in the inner city area were: D, G, H, K, M and N.

On receptive language, gains were noted for *most of* the children from the Ballyfermot area, where 12 children gained and 4 did not gain, while gains were noted for 11 children and *not* noted for 11 children from the inner city area. On expressive language, more gains were noted in the Ballyfermot area, specifically 11 children gained and 16 children did not gain, while fewer gains were noted in the inner city where gains were noted for 6 children and *not* noted for 11 children. Finally, on receptive vocabulary, more gains were noted for children from the Ballyfermot area, specifically 10 children gained and 14 children did not gain, while fewer gains were noted in the inner city where gains were noted for 3 children and *not* noted for 6 children.

Greater language gains in Ballyfermot area may reflect the presence of the elements of school and/or community sub-systems supporting language development in a normative comparison, that might have been absent in the inner city area. Furthermore, there was one school (school 2, Ballyfermot area) in which all *classes* showed significant language gains in a norm-referenced comparison (i.e. classes J, A and O). These findings invite a discussion on the importance of supports at a macro-systemic level, including such elements of a macro-system as, for instance, the school climate. School climate was, for example, recognised in a recent NESF report on child literacy (2009) as a significant contributor to children's literacy development. The discussion on system level supports was presented in chapter two.

6.1.10 Gains Clearly Observable Within the Same Classes: SFA Needs Specific Conditions to Work

In general, a class effect was observed in the research data, meaning that language gains were clearly observable in the same classes. The analysis of gains in individual dimensions for the whole sample revealed that gains tended to be observable for either all or all but one pupils in some classes. These classes are indicated by square brackets in table 14 and tables 16-18 included in the previous chapter. Furthermore, there were a few classes in which a majority of participating children showed gains in a *majority* of studied dimensions. The opposite was also observed, particularly in relation to norm-referenced receptive language, namely decreases or 'no change' outcomes were observed for either a majority or all children within the same classes. As these classes were from different schools and different grade level, these findings suggest the presence of a class effect, i.e. the presence of some elements of the classroom microsystem that maximised or minimised the efficacy of the intervention. The following accounts are an exploration of what common distinctive factors characterised the classes in which the effects of SFA were maximized and those in which the effects of SFA were minimised or hindered.

Gains in a majority of the studied dimensions were made by *individual* pupils in 10 out of 14 studied classes (i.e. classes A, B, C, D, E, F, G, H, J and N). However, it was only in classes A-senior infants, B-junior infants, C-junior infants and D-senior infants where a *majority* of pupils were observed to make clear gains in a *majority* of language dimensions. Two *common* distinctive factors were noted in these four classes. Firstly, *all* of these classes were in

classrooms that were large in terms of room size.[141] Secondly, *all* teachers of these classes were observed to present good quality of language teaching. The quality of language teaching was observed in all classes, after the review of classroom transcripts, and was characterised by the aspects described below.

Firstly, the teachers of these four classes were observed to pose many open-ended questions, an aspect of the teacher's speech that has been recognised by early childhood researchers to be one of key features of the effective early language pedagogy (Bickford-Smith, et al., 2005, for a review). Open-ended questioning encourages the shifting of power-relations in the classroom in favour of the child, an aspect of adult-child interaction that has been widely recognised as contributing to language acquisition (Girolametto et al., 2000; Girolametto & Weitzman, 2002). Secondly, the teachers of the four classes in which most gains were noted enabled expository language (i.e. a language of explanation) in addition to narrative and conversational languages in the classroom. Thirdly, they utilised aspects of dialogic reading (Whitehurst et al., 1988) in story reading activities, including language modelling.[142] Dialogic reading techniques comprise the following activities: expanding on the child's utterances, recasting, evaluating the child's responses (*He wasn't eaten/What would happen if he was eaten?)* and asking open-ended questions.

There were no other participating classes that were housed in large classrooms *and* in which the presence of all of the above aspects of language instruction were present. One can thus conclude that children in large classrooms from classes with the above features of good quality language teaching were

[141] Qualitative terms used in relation to classrooms' size were *large* and *not large*. A consensus on the attribution of these terms was reached with another observer.
[142] Use of teaching methodologies was not included as an indicator of teaching quality as the observed classes were observed in a whole class format and mostly during story time.

found more likely to show gains than others. No age and gender interactions were observed. It is crucial to recognise, however, that the observation of the quality of language teaching and the factors present in these four classrooms does not represent an in-depth analysis of the teaching approaches used by the observed teachers. The focus of analysis was directed on a few aspects of language teaching that are widely regarded to be facilitative for children's language development (see McGough, 2008, for a review). These are interaction-promoting and language-modelling behaviours that include recasting, expanding, extending conversational turns and open-ended questioning (Girolametto & Weitzman, 2002; Tannock & Girolametto, 1992).

While gains in a majority of the studied dimensions were made by *individual* pupils in 10 out of 14 studied classes, no pupils in the remaining 4 participating classes made major language gains, namely those from classes M-senior infants, L-senior infants, O-first class and K-first class. No children in class M, for instance, showed norm-referenced gains.[143] Rather, decreases in norm-referenced performance in both receptive language and expressive language dimensions were noted for a majority of the participants in this class. Possible factors that minimized the effect of SFA in these four classes are explored in the following paragraph.

The teachers of classes K, L and M were observed not to shift power relations in favour of the children, namely they posed many closed questions and were observed to discourage pupils' contributions during, for example, story reading. Classes M and L were in small classrooms in terms of the size of the room. The enabling of the expository type of language was not recorded in class

[143] Child M4 had scores of 64 on pre-intervention expressive language and 69 on post-intervention expressive language. Both of these represent the lowest possible scores for the relevant age and are indicative of a severe language disorder.

M on any occasion. It is also crucial to recognise that children in 3 out of these 4 classes in which the least gains were observed were among the oldest participants of the study (i.e. classes K, O and M). Two of these classes were first classes (class K and O), while class M was in a school where children attended a preparatory year prior to junior infants, and therefore were on average the same age as first class pupils in other schools participating in the study (see appendix B for age of participants). Furthermore, the teacher of class M was observed to wear the provided microphone *rarely/never* (the microphone was not charged for the *scheduled* recording on two occasions).

While an attempt was made to find common distinctive factors in the classes in which the effect of SFA was maximised and in those in which this effect was minimised, it is equally possible that the observed class effect was related to factors that could not be observed by the researcher. One such factor that could mediate the effect of SFA is the teacher expectations for the class. It has been argued by many researchers that it is the teacher expectations for the *whole class* that has a greater impact on pupil achievement than the teacher expectations for individual pupils (e.g., Brophy, 1985; Rubie-Davies, Hattie & Hamilton, 2006; Weinstein, 2002).

6.1.11 Unanticipated Findings: Changes in the Classroom Discourse after SFA Installation

Loquacity levels increased in 7 studied classes (50%), indicating that the observed children from these 7 classes provided *longer* contributions after the installation of SFA (i.e. classes A, B, D, E, F, G and O). A majority of pupils participating in the study from the remaining 7 classes (i.e., classes C, H, J, K, L,

M and N) were not found to produce longer contributions in the intervention phase. However, an interesting observation was made in 6 of the participating classes (namely classes E, C, A, M, O and K), including 3 of the classes in which loquacity levels showed no gains. It was observed in these classes that the linguistic material recorded for analysis was consistently richer in the *number* of utterances after SFA installation[144] (see appendices C-D for detailed scores). This observation indicates that while some children might not have produced *longer* contributions after the SFA installation, they were likely to contribute more *frequently*.

The observation that the number of utterances produced by the participating children after the SFA installation was consistently larger in 6 of the studied classes was one of the unanticipated study findings.[145] A number of factors were likely to contribute to this outcome. Firstly, some children volunteered more utterances in the intervention phase (12 out of 27 children from these 6 classes gained in participation). Secondly, the teachers were observed to direct more obligations to the participating children after the SFA installation. The teacher attention directed to the participating children was measured as the number of teacher obligations directed to the individual children to the number of teacher questions directed to the whole class. This measure was found to be consistently greater in four of the studied classes after SFA installation (i.e. classes A, C, E and M) (see appendix G for detailed scores). An increased number of pupil contributions in the intervention phase was noted in 3 of these 4 classes (i.e. classes A, C and E).

[144] Consistently meant that, in comparison to the baseline samples, the linguistic material was richer in *all* intervention study phases.

[145] The richness of language sample was not set out to be a measure of language gains due to an anticipated lesson content variability.

Thus an increased number of pupil contributions was observed in 6 out of 14 classes (43%) and an increased number of teacher obligations directed to the individual pupils was observed in 4 out of 14 classes (29%), while both of these observations were made in three classes, namely classes A, C and E. This observation may suggest that the intervention brought some changes to these three classroom systems that resulted in an increased number of *conversational exchanges* between the teacher and the observed students. It is possible that SFA improved the pupils' on-task behaviour, which reduced the time the teachers spent on managing the classroom. This might have subsequently resulted in an increase of conversational exchanges between the pupils and the teacher. One might thus hypothesise that SFA has a potential to have a positive impact on *the amount* of verbal interaction in the classroom. This finding is consistent with a hypothesis by Manlowe et al. (2001) who note that teachers experiencing voice fatigue may limit conversational exchanges with the pupils.

Interestingly, the observation of a potential increase in conversational exchanges between the pupils and the teacher was more relevant to larger classes, i.e. classes with 20 or more pupils present (5 classes were identified as larger classes in the context of this study, namely classes C, B, A, O and K; language samples were richer in the intervention phase in 4 of these classes). Based on the observation that there were more pupil contributions in these classrooms after the intervention was introduced, it is possible to hypothesise that SFA has a potential to somewhat minimise the negative effects of larger classes on the amount of verbal interaction (i.e. minimise the time spent on managing larger classrooms), a claim that is frequently made by various commercial SFA advocates, yet one that has not been directly studied for early

childhood populations in SFA literature. Classroom sound field amplification was found to reduce the time spent on managing the class in the middle school physical education classes (Ryan, 2009).

A final explanation for an increased number of children's contributions after SFA installation may be what is often termed the Hawthorne effect (Landsberger, 1958). The Hawthorne effect refers to one's change in behaviour when one is observed. It is possible that some teachers presented more structured lessons at the start of the study, which would result in fewer elaborations made by the children during the baseline, and less structured lessons when they became accustomed to being videotaped (i.e. later in the intervention phase). Similar influences were reported by other studies that used video cameras (Girolametto et al., 2000).

While the observations were conducted in whole class settings, it is assumed that the teachers utilised a variety of teaching approaches while wearing the microphones (whole class format was requested specifically only for data collection, see chapter three for details). Group work has been recognised to be pedagogically more beneficial than whole class teaching (e.g., Hayes, 2004), although most Irish teachers still report the use of a combination of whole class, group and individual work approaches (Darmody et al., 2010). It is important to recognize that SFA can be used creatively in the classroom by passing the microphone to the children and thus amplifying the *children's* - as opposed to the teachers' – speech. Such SFA use is likely to bring a number of benefits apart from the expected improvement in the audibility of children's speech, including a positive influence on children's self-esteem and a regulation of the turn-taking during group discussions.

To conclude, this study showed that the observed children's verbal contributions increased after the installation of SFA in most studied classrooms (i.e. the number of utterances increased in comparison to the baseline data; see table 19 and appendices C-D for detailed scores). In other words, the observed children spoke either more often or in longer contributions after the introduction of the intervention.[146] Thus, one of the possible hypotheses arising from this study is that the social processes in the observed classrooms might have changed after the SFA installation. It is possible that the children were encouraged, either directly or indirectly through improved listening conditions, to participate more actively in the classroom discussions.

6.1.12 Conclusion: SFA Effect is 'Constructed'

This section elaborates further on the finding that the SFA effect is mediated by the conditions created within the child's system. A few children (8 out of 62; 13%) gained in almost all studied language dimensions (i.e. children B3, B1, B2, E2, C1, C2, N3 and D2); other children exhibited variable outcomes on different language dimensions. Those eight children for whom English was the first language were of mixed gender and had varying baseline language abilities. However, a large majority were in junior infant classes (7 children were junior infants and child D2 was a senior infant) with a majority of them presenting with teacher identified attention difficulties at baseline (5 out of 8 children; 63%).[147] Interestingly, almost half of them came from the same class, namely class B. Norm-referenced expressive language gains were noted in class

[146] One conversational turn might have included a few utterances (see chapter three for the criteria of the segmentation into utterances).
[147] Thirty one per cent of children in the whole sample presented with teacher-attributed attention difficulties at baseline (i.e. 20 out of 65 children).

B for *all but one* participant[148], and gains in *a majority* of language dimensions, both classroom-derived and norm-referenced, were noted for *most* of the study participants from this class. There were a number of distinctive factors identified in this class, including the teacher wearing the microphone every day the researcher arrived, good quality of language teaching[149] and a large classroom with many children in the class[150] (i.e. a larger class *and* a larger classroom).

Unlike other SFA evaluations, this study showed no gain outcomes in some of the studied classrooms. This is in contrast to previous SFA studies that almost uniformly reported positive outcomes. Moreover, a deterioration of language performance was noted in many classrooms with no positive outcomes. These findings 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 bring different outcomes in different system conditions. The fact that SFA proved supportive to individual children and classes and not to the whole sample studied does *not* prove that SFA is not beneficial. Rather, it proves that SFA *can* be beneficial for some children *and* in some situations, i.e. under certain conditions. Interestingly, if one adopted a cluster approach, gains (large, incremental or marginal) would have shown on all language dimensions observed in the classrooms except grammatical correctness. However, when one analyses individual classes and the individuals within these classes, the evidence of gains presents a more complex and varied picture.

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[148] In the whole sample, fewer than half of all study participants gained in norm-referenced expressive language.

[149] As characterised by the aforementioned aspects, namely: open-ended questions, dialogic reading techniques including language modeling, expanding and recasting, as well as expository language enabling and shifting of power relations in favour of the pupils.

[150] In the context of this study, i.e. in comparison to the other studied classes.

It is important to reiterate - as was argued in the second chapter - that a number of conditions need to be met for language development to take place, with good classroom acoustics as a potentially crucial element for some pupils. This study evidenced that the SFA effect in the classroom is mediated by other elements of the system. Three children (i.e. children L3, E2 and M3) who experienced family difficulties during the study - as reported by their teachers - did not present any language gains or presented smaller language gains to their classroom peers. This was despite many classroom and school-based supports they received. One can thus conclude that personal and family problems might have hindered or minimised the efficacy of SFA for these children. However, family problems, reported by the teachers, did not always hinder language development of the studied children. Teacher of class N reported family problems of two children from her class (child N2 and child N3) at a particular time during the intervention; but these were not found to change the observed classroom language performance of these two pupils. One must thus make an obvious conclusion that the impact of family difficulties on classroom performance depends on the *nature* of these difficulties.

The potential benefits of SFA were found to be also hindered by a lack of supportive classroom climate or a lack of motivation as in the case of a child K4 who received frequent negative feedback from his teacher and whose performance decreased on a majority of classroom derived dimensions. Interestingly, child H2, whose expressive language skills at the baseline were assessed to be above the norms for his age, was observed to be disengaged in the tasks with lower abstraction level, e.g., labelling animals. His participation and responsiveness were clearly lower during the activities that were presumably

unchallenging to him. On the other hand, child B4, who was the youngest study participant as she was only 3 years of age when the study started[151], was observed not to participate in tasks that were more cognitively challenging.

It is also possible that the benefits of SFA were minimised for child H4 who was observed to be withdrawn during some recorded lessons, perhaps due to some personal problems. Another child (child E4) developed a stammer near the end of the study and her awareness of this speech difficulty affected her classroom responsiveness. Child B6 who missed school often showed clearly lower language scores after a period of prolonged absence from school. Absenteeism was also shown to affect classroom performance of child L4. Furthermore, it is important to acknowledge that SFA cannot support children in situations when they might have vision difficulties, as in the case of a child A2, who could not participate in a lesson because, according to his reports, he could not see the poster presented by the teacher (participation was lower also in class E when the teacher required the pupils to label the shapes on the poster while some children were recorded as saying *Teacher I can't see*).

Some classroom conditions were observed to particularly support improved language performance. Substantial gains, especially in participation, were noted if, for example, the subject of the lesson was familiar to the pupils. Participation, on the other hand, was clearly lower during particular times of the school year (e.g., before Christmas or before summer holidays). Furthermore, a child who had an SNA assigned to her shortly after the introduction of the intervention also showed gains in the classroom performance (child E5). A more

[151] One may argue that this child was too young for a formal education system.

detailed elaboration on this complex network of the elements observed to influence language performance in this study was presented in chapter four.

This study is unique in that, in contrast to previous SFA literature it discusses the elements of a child's system that support or hinder the efficacy of this intervention. The effect of SFA is *maximised* if other conditions of the child's system that support language development (including the school system) are met. The findings presented in this study support the hypothesis that SFA *can* aid language development of children with potential speech and language difficulties from infant and first classes in urban designated disadvantaged schools in Ireland. As this study showed, however, this hypothesis can only be true under the assumption that SFA is brought into a system whose other elements are not operating in opposition to the goals of this intervention. The benefits of SFA are hindered when other elements of the child's system are not 'aligned' with the goal of this intervention, i.e. if they do not support the child's language learning. These elements relate to family situation (as in the aforementioned cases of children L3, M3 and E4), in-school attendance (responsiveness and participation of child B6 was observed to be clearly lower after periods of his prolonged absence at school), and - most importantly - the classroom microsystem with the quality of language teaching and the classroom climate as its key elements.

Furthermore, the finding that language gains were clearly greater in one geographical area studied in this thesis indicates the importance of a macro-systemic level that supports the efficacy of this intervention. One must recognise that the effect of SFA is not 'a given', i.e. narrowly deterministic. Rather, this effect is actively constructed by the teachers *and* constructed differently for each

child in the classroom. This was not recognised by most previous SFA researchers who did not examine the possibility that SFA may contribute to different outcomes in different settings and for different individuals.

The absence of language gains (or the deterioration in language performance) observed in some classes must be interpreted in the context of the unique characteristics of the studied children who experienced socio-economic disadvantage (DEIS schools) *and* potential speech and language difficulties. McCartney (1999) noted that some children with speech and language difficulties may benefit from the intervention but that the amount of change they experience may be smaller than the amount of change that would have been expected from 'normally developing children and without intervention' (p. 167).

Finally, it is possible that the intervention prevented difficulties for participants who made no visible/perceptible progress in some language dimensions. Furthermore, it is worth remembering that when it comes to evaluating early interventions, it may be difficult to capture the clear-cut outcome changes, as early intervention is expected to *prevent* problems in the first place.

6.2 Implications and Recommendations for Further Research and Theory

6.2.1 Implications for the Development of Systems Theory in Education

The results of this research suggested that the effect of SFA on language development is mediated by other elements of the child's system, in particular the classroom microsystem. Firstly, the outcomes of this intervention differed in different classrooms. The class effect was most clearly observable in senior

infant classes, where gains were observed in two classes and no gains were observed in one class. For junior infants, there were two classes in which gains were clearly greater than in any other junior infant class. Secondly, the outcomes of this intervention for children with specific characteristics tended to depend on which class they attended. Some children for whom English was an additional language (EAL), for instance, showed gains in a majority of the observed language dimensions, if they came from classes where in general large gains were noted. Other EAL children did not show many gains if they were in classrooms in which not many gains were noted. This finding is in contrast to the claims made by previous SFA studies recording uniformly large gains for EAL children in academic achievement (Crandell, 1996; Massie & Dillon, 2006a; 2006b).

One can thus state that it is the interaction between the various elements of the child's system relating to both the individual characteristics and to the classroom microsystem that combines in creating the supporting conditions for the efficacy of this intervention. In other words, it is the presence of supporting background conditions that enable the efficacy of SFA. This observation has major implications for other interventions introduced into the classroom system as it clearly shows that the intervention can only be effective if the conditions of the sub-system it operates within support its goals. This observation is particularly relevant to the quality of teaching, a key element of the classroom sub-system. Implications for teachers and teacher training colleges arising from the observed quality of language teaching will be discussed in detail later on in this chapter.

Non-systemic educational interventions that target only specific dimensions of the system - and it can be argued that SFA targets only the listening channel - need specific systemic conditions 'to work'. Other parts of the system need to operate in alignment with their goals. This perspective goes beyond the narrowly deterministic one that currently underlies many efficacy studies in education and most efficacy studies in the speech and language science. The view of the education as a living organic far from equilibrium system was developed in chapter two. The classroom is conceptualised in this perspective as a system in a constant state of dynamism. Narrowly deterministic linear approaches cannot be applied to such systems. Phenomena are not 'a given' in such systems but they are constructed actively by the system subjects. While constructivist perspectives in education have long been theoretically acknowledged, particularly in relevance to learning theories (i.e. that knowledge is not transmitted but constructed by individuals from their own experiences), they have not been commonly applied in the field of intervention studies. It is argued in this thesis that the effect of an intervention in a complex living system cannot be simply 'assumed'. Rather, this effect is actively constructed by the individuals present within the system.

While SFA itself, in contrast to most educational interventions, does not adapt much to its context, and thus remains rather stable in form, its effect differs in each context and for each individual. One may thus conclude that one of the most important theoretical implications arising from the current study is the necessity to move the focus from the intervention per se to the system in which the intervention is delivered. Hawe and colleagues (2009) suggest:

> The interrogation of intervention logic is welcome and potentially productive. But rather than attempting to think or do things differently, it could be argued that all that has been achieved is more meticulous ways of doing the same thing (...) Instead, we suggest that the interrogation of theory should occur in a manner far more fundamental than currently supposed. Borrowing the words of the physicist Anderson, we should be looking more at the chemistry and less at the atoms (p. 269).

Current SFA literature is an example of a string of studies that combine into a process that Hawe calls 'more meticulous ways of doing the same thing'. It represents an example of a particularly traditional approach, which pursues some absolute truth about the SFA, namely that SFA is an effective classroom intervention. The conceptualization of SFA as an intervention within the systems theory sciences directs the focus on the child and the systems this child belongs to as opposed to the focus on the 'resource' per se. Similar focus is needed in other intervention studies.

It is recognised in this thesis that systems theories operate frequently on a conceptual level and that their applications to the methodologies of intervention studies may prove problematic. Systems theories necessitate the application of a complex causality, i.e. a circular causality with some unexpected and emergent properties, as opposed to a simple linear one of one-antecedent-one-consequence. Complex causality implies in turn an infinite number of system elements operating simultaneously at any one time in complex systems as well as the emergence of unexpected properties. There are a myriad of factors affecting the learning and development of a child that are not known to the researcher. For instance, some decrease in language performance of child L3 in this study could not be attributed to the classroom factors. Out-of-classroom factors, e.g. personal problems, can only be assumed in this situation. The

marriage of systemic thinking with intervention studies in the area of research methodology is an area yet to be developed.

Henning (2009) notes that the application of constructivism (and systemic thinking is broadly consistent with constructivism) to quantification of evidence (i.e. to traditional methodologies) 'does not necessarily lead to either new methodology, or to discarding old ones' (p. 52). He proposes that it is more about augmenting the *understanding* of the model and the ways in which the researchers see their topics. One might ask if it is useful at all to study SFA, or indeed any educational or language intervention, if one assumes the presence of an infinite number of factors simultaneously influencing a behaviour. This study proposes a model whereby the intervention-outcome attribution is possible, if proven by research data, but only in the presence of certain background system conditions. In other words, as Quine (1953) would argue, such attribution is 'enabled' only if certain auxiliary hypotheses are met (that are largely un-stated but presumed). Thus, while the current study presented some quantitative data, and as Henning (2009) observes 'all methods (of quantification) are riddled with conceptual difficulties' (p. 39), these were qualified with systems theory perspectives.

6.2.2 Need to Develop Literature on Speech Language and Hearing Levels in DEIS Schools

The results of this study provide evidence that the intervention was more beneficial in junior infant classrooms in which SFA was installed at the start of the school year. This trend may reflect the effect of schooling on language performance of children living in areas of socio-economic disadvantage. It is

generally recognised that children living in poverty are more dependent on school in terms of literacy development (McGough, 2007). There has, however, been little research on how language levels of children taught in schools designated as disadvantaged in Ireland change in relation to the norms for age over the course of their primary education. This remains an area for further research.

This research showed that a majority of children in all age groups made gains in norm-referenced receptive language. The outcomes on other studied language dimensions differed, however, for each age group and for each class. This may indicate that there were some aspects of teaching that supported the growth of language in particular dimensions. Loquacity, for example, might have developed only in classrooms whose teachers used teaching methodologies that supported longer contributions. On the other hand, teachers' questioning methods might have affected the responsiveness of children. While a detailed analysis of this kind was beyond the scope of this study, it is recommended that future researchers explore it further.

The results of this study showed that a majority of junior infant pupils made gains in pragmatic appropriateness, while this was not the case for pupils in other age groups. Furthermore, gains in this dimension were more likely to be made by children identified by their teachers at baseline as experiencing attention difficulties. Gains in pragmatic appropriateness for junior infant pupils *may* indicate that these children were more on-task and/or that they could hear the teacher better after SFA installation. It is not known if children who might have attention difficulties in DEIS schools provide less pragmatically

appropriate and adequate contributions in the classroom, and if this is more relevant to junior infant pupils. These are areas for further research.

The audit of research on early childhood care and education in Ireland 1990-2006 (Walsh & Cassidy, 2007) suggests that research concerned with classroom acoustics and the hearing levels of children in Irish infant classes in mainstream schools is almost non-existing. This is also the case with Irish studies on speech and language needs of children living in areas designated as disadvantaged. While some current Irish researchers focus on the language difference of the socio-economically disadvantaged communities (Cregan, 2006, 2007; Mac Ruairc, 2004), evidence suggesting that a larger number of children in DEIS schools may be in need of speech and language interventions is still insufficient and requires further extensive research to confirm or disprove.

6.2.3 Areas for Further SFA Research

Two children participating in this study who presented with speech difficulties at the baseline assessment were observed to present with improved speech at the end of the study. Their performance on language dimensions relating to word structure, specifically the Word Structure component of CELF and grammatical correctness, was affected by their speech difficulties at the baseline assessment. At the end of the study, the scores on these two dimensions improved as their speech was observed to present fewer phonological problems. It is possible that SFA supported the development in phonology for these two children, as they were not known to attend any speech and language services during the study. The possibility of SFA benefits for phonological development, including phonological awareness, should be evaluated, particularly for children

in designated disadvantaged areas. Some researchers claim that meta-linguistic weaknesses, including weaknesses in phonological awareness, are more prevalent in areas of socio-economic disadvantage and that these may contribute to poorer literacy standards in these areas (Chaney, 2000).

Language gains shown in this study occurred more frequently in classrooms that were larger in terms of the size of the room. One must acknowledge, however, that the classroom characteristics were not quantitatively measured in the study. Quantitative measurement of classroom characteristics would involve measuring the actual physical size of the room, the reverberation level and the level of ambient noise. Future researchers could explore further the link between the classroom characteristics and the SFA effect, in order to determine the type of classroom in which this intervention is likely to be most beneficial.

This evaluation showed that gains tended to be present in certain classes and absent in some other classes at the same grade level, a finding indicating a teacher effect. Given a possible teacher effect, it is recommended that future researchers studying SFA evaluate its effect on the same class but with different teachers and in different classrooms, e.g., across a few academic years. This would enable an exploration of whether the benefits of this intervention are carried over to other classes and of what happens when children change classrooms and teachers. The teacher effect, however, may not be the only element contributing to a particular outcome in the class. It was observed that language performance on such measures as participation and responsiveness markedly decreased in class D in the new school year, even though the same teacher taught the class. It is possible to interpret this finding in the context of

so-called 'negative learning' (Cooper et al., 1996) that might have occurred during the summer months.

The importance of measuring changes across school years in the SFA literature was previously noted by Allen and Patton (1990) who measured on-task behaviour under the amplified conditions. This was not implemented in the present study due to an already huge variability in the lesson content and a relatively limited research timeframe. However, if the lesson content was controlled in some way, for example, the recordings were taken during story time only (or story production)[152], such measurement could be implemented.

The educational benefits of classroom sound field amplification systems have been studied in a number of American classrooms for over three decades, yet the SFA literature seems to be still underdeveloped. Many SFA evaluations are small-scale research projects based in one school and funded by the companies supplying the system. A large majority of SFA studies published in peer-reviewed journals are based on a linear view of development. This study initiated a systemic approach in SFA literature. There is a need to develop the literature on SFA by focusing on strengths and weaknesses of this intervention and the elements supporting and hindering its efficacy. While this study revealed a somewhat obvious - yet ignored by previous researchers - link between the teaching and the SFA, future researchers may focus on specific dimensions of teaching that support the efficacy of SFA in relation to language. There is a need to develop large-scale good quality research on SFA, as well as to develop SFA literature in mainstream classrooms in Ireland.

[152] Children who generate a story were found in research to produce equivalent productivity measures (e.g. number of total words, number of different words and number of clauses) on two different occasions (Pena, et al., 2006). Furthermore, some features of children's language (particularly in the area of pragmatics) are thought to remain stable across different interlocutors (Adams, et al., 2006).

6.4 Implications & Recommendations for Policy and Practice

6.4.1 Language and Attention Needs of the Participating Children

This study provides evidence that the language needs of children in the early years of school in areas designated as disadvantaged in Ireland may be of a similar concern as in England or America (see Locke et al., 2002, for English and American data). Teachers participating in this study were asked to select five children with potential speech and language difficulties from each class. It is crucial to reiterate that the average number of children in the studied classes was fifteen. Fifty seven per cent of children selected by their teachers and assessed for the purposes of this study had language levels below the normative level in a standardised comparison, with almost every fifth child within this group performing at 2 or more than 2 standard deviations below the mean. While it is crucial to emphasise that these figures do not constitute a representative sample of either the studied population or DEIS schools in Ireland, they may suggest that language needs in some schools designated as disadvantaged are a concern.

The data collected in this study revealed that as many as 38 per cent of participating children, i.e. children with teacher-attributed speech and language difficulties, also experienced potential attention difficulties (as reported by the teachers). This highlights the need to develop classroom supports that have a potential to target both areas of difficulty. Classroom sound field amplification system may be a unique intervention as it purportedly supports speech and language development by improving the pupils' on-task behaviour. It is important to restate that children with potential attention difficulties at baseline

showed greater language gains, and greater receptive language gains within this. These findings suggest that SFA has a potential to enable a better listening channel for these children. The possible existence of a relatively substantial number of children who potentially experience both language and attention difficulties in infant classrooms of designated disadvantaged schools poses much challenge to the teachers teaching in DEIS schools and highlights the need to develop supports for both the pupils and their teachers.

There were some children who made gains in norm-standardised language but who still presented with language levels below the norms for age at the post-intervention assessment. These children were not reported to receive any speech and language therapy services during the course of the study, which in most classes lasted a full academic year. This suggests that some children with language needs are not being identified in DEIS schools.

It was observed that children who did not gain in norm-referenced expressive language or receptive vocabulary were likely to deteriorate in language performance. This meant that children who did not benefit from SFA due to some systemic conditions hindering SFA efficacy and their language development, deteriorated in performance. Furthermore, it was observed that children with potential attention difficulties were more likely to deteriorate in language performance than the children without such attributed difficulties. While there were only 5 children with teacher-attributed attention difficulties who did not show gains from the intervention, four of them deteriorated in language performance. This finding highlights the need for language interventions for these children. The results of meta-analyses of intervention research suggest that children from designated disadvantaged backgrounds who

do not receive educational interventions generally decline in performance with age (Bryant & Maxwell, 1997). Future SLT researchers in Ireland could explore whether this claim relates also to *language* performance in DEIS schools.

Department of Education and Skills guidelines recommend additional resource hours for children with language difficulties of more than 2 standard deviations (SD) below the mean in at least two language modalities, provided that their cognitive level is less than 1SD below the mean (+90). The potentially[153] large number of children presenting with such difficulties reflects the need for this support, as well as the need for more *classroom-based* supports for all children with language difficulties. If the data of this research were to be applied to a hypothetical classroom, every fifth child in this class would present with a language delay while only 1 in 15 would be able to access additional resource hours. This opens up a whole area of research on innovative language interventions, both those classroom and out-of-classroom based (e.g., developing language programmes with the parents through HSCL), for pupils in schools designated as disadvantaged. Despite recent Irish research on language and literacy in the context of educational disadvantage (Kennedy, 2008; McGough, 2008), literature on speech and language in this context is seriously underdeveloped in Ireland.

The probable presence of high language needs of pupils in Irish infant classrooms has implications for classroom teaching. Primary-level teachers in Ireland are currently not uniformly taught modules on language teaching at a pre-service level. Only recently, a DES report on literacy (DES, 2010b) set out proposals for re-configuration of the teacher education in Ireland. This re-

[153] Cognitive levels of children participating in this study were not assessed.

configuration will include teacher training in the aspects of speech and language that are relevant to literacy teaching. However, speech and language was identified as an area of priority already by the DEIS strategy (DEIS, 2005b). Irish teachers surveyed in 2005 reported that pre-service education did not prepare them sufficiently to teach language and literacy with confidence (IDES, 2005a). At the same time, newly graduated teachers reported that they felt least professionally prepared to teach infant classes (IDES, 2005c). Given the importance of teaching language in infant classes in DEIS schools, this is an important area of urgent need. Collaborative models of responding to language needs internationally have included the recommendation for some joint teaching for speech and language therapists and teachers at a pre-service level (McCartney, 1999; Mroz et al., 2002; Mroz, 2006). The feasibility of such model in Ireland could be explored during the consultation process on the DES draft national plan to improve literacy levels (DES, 2010b).

6.3.2 Type of Language Difficulties Experienced by Children in DEIS Schools

The baseline linguistic data showed that the participating children's weaknesses were most prominent in the dimensions of syntactic complexity and loquacity. In other words, as a group, children who were considered by their teachers to experience speech and language difficulties had largest difficulties in building longer elaborated responses that are syntactically complex.[154] On the other hand, most of the participants presented with good baseline scores in grammatical correctness. Consequently, there was little scope for improvement in this dimension. In simple terms, this means that the studied children

[154] Based on baseline loquacity and syntactic complexity scores as well as subtests of expressive language component of standardised language tests

experienced weaknesses related to the quantity rather than to the quality of language. In other words, it was not the grammatical errors but the lack of elaborated complex syntactically responses that were most prominent in the collected language samples.

Contextual factors could not have accounted for this situation as weaknesses in sentence structure in contrast to stronger profiles in word structure (i.e. grammar) were noted also in norm-referenced performance, i.e. in language performance that was not observed in the classroom. Furthermore, while the baseline profiles showed large weaknesses in loquacity and syntactic complexity, gains in these two dimensions were recorded in only half (7 classes gained in loquacity) or fewer than half (6 classes gained in syntactic complexity) of the studied classes. Children in the remaining classes did not make gains in these two dimensions throughout the whole academic year.

It is crucial to note, however, that the baseline profile of loquacity and syntactic complexity dimensions could not be established for a small number of participants (22%) due to limited productivity of the collected language samples, and specifically limited number of clausal utterances in the baseline data.[155] While it is recognised that the requested whole class teaching format might have limited the collection of linguistic data[156], it is important to reiterate that the majority of the observed lessons occurred in classes with fewer than 15 pupils, a number which most researchers studying the class effect on academic

[155] This means that throughout 3-5 baseline recordings of 30 minutes each, fourteen children produced only single word and phrase utterances and formulated no sentences.
[156] It is, however, also possible, although very unlikely, that these children's language level was at a single word or phrase level.

achievement classify as 'a small group' setting (see Folmer-Annevelink et al., 2010, for a review of studies on class size).[157]

Irish sociologists studying a language difference of socio-economically disadvantaged populations have noted that despite the fact that this language difference is largely structural, language teaching focuses predominantly on the substance of language, not on the linguistic choices required for the language content to be expressed (MacRuairc, 1997; Cregan, 2007). The absence of teaching in linguistic choices at school creates a situation where the school 'demands' what it does not teach. If one considers the well researched inter-dependence between literate language and literacy skills (Lorch et al., 2007; Whitehurst, 1997), it seems that teaching the elements of the structure of language has the potential to advance literacy levels, and especially reading comprehension, in DEIS schools (Cregan, 2006; 2007).

The recommendation for teachers to teach the elements of the literate language in designated disadvantaged schools has implications for pre-service education of teachers in Ireland, who currently receive no formal training on the grammar of language at a pre-service level.[158] It is recommended that language teaching in areas designated as disadvantaged includes teaching children how to

[157] Murphy (1999) examined classroom language in Irish infant classes and found that the children talked for only 35 per cent of the time, out of which 13 per cent was devoted to whole class repetitions and only 2 per cent to dialogue. Talking in the classroom is important as a classroom with its linguistic and social demands is often the first environment in which a child's learning difficulties are recognised (Donahue, 1994). Similarly, Horgan (1995) and Hayes et al. (1997) reported low levels of interaction in Irish junior infant classrooms.

[158] The foundations of linguistic knowledge about sentence structure (i.e. about simple and complex sentences) would prove useful in the dynamic assessment of children's language competence. Children who were 'quiet' were judged to have language problems by a teacher in class A. Indeed many language-impaired children are less likely to initiate dialogue than their peers who perform linguistically at a normative level. However, while some reticent children may chose not to volunteer to respond, the 'quiet' children in class A were able to produce syntactically complex and grammatically correct utterances when *obliged* to speak. This related to three female participants, namely child F-A1 and child F-A2, whose baseline standardised language scores were well within the norms for age, and child F-A3, whose baseline language skills were exceptional in a norm-referenced comparison (i.e. above the norms for age).

build more syntactically complex responses, in addition to creating the contexts for elaborated discourse type (e.g., for expository type of language). These recommendations add to those of Cregan (2006; 2007) and the authors of a recent DES report on literacy (DES, 2010b), who suggest that children in DEIS schools might have weaker competencies in the literate type of language.

6.3.3 Differences in the Quality of Language Teaching

Large discrepancies in the quality of the recorded language and literacy lessons have been observed in the course of this study. Good models of language and literacy teaching were not recorded in every class participating in this study. However, a cautionary note should be employed to this observation as the requested format of whole class lessons and a relatively limited number of observations, with a mean of 10.7 observations per class (range: 7-15, SD=2.94), might have provided only a fragmented picture of what was really happening in classrooms. The observed differences in language teaching related most often to the teachers' use of language modelling and discourse enabling strategies. These are explained below.

Discourse enabling strategies in the classroom include a range of language eliciting methods, such as recasting and expanding, as well as the questioning methods used by the teacher. Open-ended, non-directive questions that extend conversational turns are generally considered to be a key feature of the early years' effective pedagogy as they are associated with better cognitive achievement (Siraj-Blatchford, et al., 2002, p. 55). Many researchers demonstrated that children aged 4-5 can provide long and interesting responses to open- ended questions that encourage thinking (e.g., in terms of drawing

inferences or producing alternatives).[159] One teacher in the current study (teacher of class M) was observed to present mainly activities that had the shortest perceptual distance such as labelling, which is associated often with closed type questions of the kind *What is this*? Children in this class were rarely required to 'move away' from the immediate physical context. Practice in such 'abstract' or decontextualised talking is, however, necessary in order to achieve good literacy levels, particularly for socio-economically disadvantaged children (Beals, et al, 1994; Curenton & Justice, 2004).

Enabling expository language (i.e. a language of explanation) in the classroom - in addition to conversational and narrative languages - is another strategy for expanding communicative competence. Expository discourse enables a literate type of language, a specific elaborated discourse that is paramount to success in school (Cregan, 2006; 2007; Lorch et al., 2007; Whitehurst, 1997). It was found that almost half of the observed teachers did not create the context for expository type of language in their classrooms during the observed language lessons. Expository language in early childhood education settings is typically generated by tasks that focus on comparing/contrasting (e.g., What is different about these pictures?) or problem/solution-tasks (e.g., How can she escape?).

Three of the observed teachers did not implement interactive models of story reading (classes M, K and L). In other words, they were observed to read stories to children almost without inviting them to interact with the text. Researchers argue that it is the *quality* of adult reading - and particularly the adult encouragement of children to discuss new meanings - that have the greatest

[159] Cherubini, Gash & McCloughlin (2008), for instance, used open-ended questions to stimulate children's discussions about plant growth (e.g., What is a seed?, Why do plants sit in the ground?, Then what happens?, How come?, What tells you that the plant is breathing?).

impact on language growth and new vocabulary acquisition (Reese & Cox, 1999; Zevenbergen et al., 2003; Walsh, 2006). Interactive story reading includes such activities as recasting, expanding on the child's utterances and evaluating the child's responses (Whitehurst et al., 1988; Whitehurst, 1997). Teacher of class M, for example, was *not* observed to implement these techniques; she was observed to pose questions without building on the children's responses, as in the following extract from the classroom transcripts[160]:

Teacher: *What do you think he does next Sean?*
(Sean puts a hand up)
Teacher: *Yes Sean what do you think he does next?*
Sean: *He eats the grass*
Teacher: *What do you think he does next Tyler?*
Tyler: *Robs*
Teacher: *Robs what*
Tyler: *Robs the horse*
Teacher: *What do you think he does next Scott?*
Scott: *Cause he ask he ask he ask sheep and he ask for food*
Teacher: *Ok/ what kind of a sound would a hen make Nathan?*

In contrast, the teacher of class C was observed to expand on children's utterances, thus modelling language and extending conversational turns, as in the following example:

Teacher: *It's not much fun being a Ginger bread man why not?*
Natalie: *Cause you are running away*
Teacher: *He has to run away from all these people why?*
Josh: *Cause he is afraid*
Teacher: *He is afraid of them/ and what do they want to do to him Josh?*

[160] Children's names in the extracts from classroom transcripts were changed.

Josh: *Eat him*

Teacher: *They want to eat him/ and he doesn't want to be eaten/ so he is afraid*

Undertaking story-based activities is one of key methodological approaches recommended in the curriculum for infant classes. Story-based activities include the processes of activating prior knowledge, predicting (e.g. Where is he going to go now?) and categorizing (e.g., What other animals might she meet in the forest?), as well as important processes that support the development of expository type of language and of meta-linguistic skills, namely synthesizing (composing parts into a whole; e.g., What would happen if?), and analysing (decomposing a whole into parts; e.g., Why did she go there?).

De-contextualized teaching of phonics was observed in two classes (classes H and J). Teachers in these two classes were observed to present letter-sound correspondences without the context of 'real' words. Such instruction limited this activity to 'teaching the sounds', including non-linguistic sounds (e.g. 'the sound of a puppy with a piece of a rug in its mouth' for phoneme 'r'), often to children who appeared to be phonemically unaware (Kazmierczak, 2007). Weaknesses in phonological instruction are one of the most often found weaknesses in classroom instruction as noted by some previous international researchers who observed teachers in the classrooms (Siraj-Blatchford, et al., 2002).

Many of the observed children, particularly in classes H and J, were recorded to be challenged by phonological awareness (PA) tasks introduced by their teachers, in particular requests to provide words starting with particular sounds (e.g., T: Think of a word beginning with p; Child: House). It was observed that PA was frequently tested by the teachers (e.g., Give me words

beginning with s/ What is the first sound in 'sun'), instead of being taught to the phonemically unaware pupils in the top-down approach (e.g., I will say words that start with the sound 'p' and you will repeat them/If I say a word that does not start with 'p' you are not to say anything: peacock, panda, elephant, etc.). Given the now well established link between phonological awareness and literacy skills, the observations of children's weaknesses in this area highlight the need for a good quality phonological awareness facilitation in infant classes of DEIS schools.

The recent draft national plan to improve literacy and numeracy standards in Ireland (DES, 2010b), highlighted the importance of teacher professional development in language and literacy teaching. It identified that the knowledge of the structure and function of oral and written language is one of the core aspects in literacy teaching and practice. The action plan recommends re-configuration of teacher education programmes to ensure the development of the teachers' skills in literacy and numeracy teaching. The knowledge of language acquisition is identified in this plan as an important component of these skills. The proposed plan recognises the difference between communicative and academic competencies in language in EAL learners and that such a difference can be relevant as well to some children living in areas of socio-economic disadvantage. The current study showed that ability to build elaborated complex syntactically responses is indeed one area of linguistic weaknesses of the studied children.

This study showed diversity between classes in terms of adult-child relationships and the teachers' skills to facilitate language development. While language was recorded in the present study in a whole group setting, there were

some classrooms in which child-centered approaches were evident. In those classrooms, children were given a choice of a story to read, were actively encouraged by the teacher to discuss the story before, during and after the reading, and teacher-pupil conversational exchanges were sustained for longer that one turn. While it is recognised that many early education researchers would argue that the cited approaches do not constitute *truly* child-centred perspectives, as for instance activities that give a child a choice are still placed in a larger context of an adult-directed activity, it must be acknowledged that they were in stark contrast to the teacher-centred approaches adopted by the teachers in some other observed classrooms.

It is possible that smaller classes in the current study (with an average of 15 children per class) accounted for some of the variations in the levels of responsive interactions between the teachers and the pupils. Smaller class sizes are generally associated with more adult-child interactions. Furthermore, the teachers were requested to present lessons that 'will generate talking' and the storytelling activity was recorded as the most common language activity in this study. The participating teachers were aware that the researcher focused on recording language samples of the observed pupils.[161] It is crucial to reiterate, however, that while language rich environment was recorded in some of the studied classrooms, there were other classrooms in this study where a more didactic, adult-centered teaching took place.

The quality of language teaching has major implications for the understanding of the efficacy of SFA in the classroom system. As argued earlier in this chapter, 'the effect' of SFA is not 'a given' but it is constructed by the

[161] It is possible that the finding that the teachers directed more obligations to the observed children after the installation of the intervention is somewhat linked to this awareness.

teachers in each class. The key background conditions that enable the efficacy of SFA include elements relating to the classroom microsystem, such as the classroom climate and the quality of teaching. It is crucial to recognise that these elements can minimise or even hinder 'the effect' of SFA.

6.3.4 Current Lack of Acoustic Standards for Classroom Design

The need for improved listening conditions in junior infant classrooms was highlighted by the results of this study that clearly show that language gains were more likely to occur in junior infant classes. Pupils in junior infant classes have less mature listening skills and are usually taught using more active teaching methodologies that may generate more internal noise. The evidence presented in this study, namely that children with potential attention difficulties and a norm-referenced language delay at baseline were either more likely to show language gains or to show greater language gains, supports the hypothesis that SFA can constitute an important classroom support in schools designated as disadvantaged, where there is a higher prevalence of these difficulties.

Currently in Ireland there are no acoustic standards for classroom design. Many urban designated disadvantaged schools are housed in old buildings that are more likely to have acoustically poorer classrooms with high reverberation levels. Noise levels, both those external and those internal, further disadvantage the pupils, especially in infant classes, where internal noise levels are likely to be higher with the use of more active teaching methodologies. Noise can be one of the factors 'disrupting pupil concentration' (Darmody et al., 2010, p. XII) while loss of speech over distance can affect speech intelligibility and speech comprehension (see Millet & Purcell, 2009, for a review).

The current recommendation for classroom design is 80 square meters for the floor area (DES, 2007). A recent report on classroom and school design in Ireland (Darmody et al., 2010) recommends that this should be an absolute minimum, especially in infant classes. Interestingly, the results of this research showed that language gains were more likely to occur in classrooms that were categorised as larger in the context of this study. This finding suggests that recommendations for larger classrooms should be accompanied with a discussion on the acoustic qualities of these classrooms as well as the voice training of the teachers teaching in them.

6.3.5 Potential Linguistic Bias of Parts of Standardised Language Tests Widely Used in Ireland

In the present study, children's syntactic competence was measured through Recalling Sentences subtests of expressive language component of CELF. Sentence imitation tests, however, have been critiqued by some researchers (Fujiki & Brinton, 1987; Prutting & Connolly, 1976; Scott, 1988) who pointed out the lack of 'open format' of such tests and their limited sensitivity towards characteristic grammatical features produced by culturally and linguistically diverse populations.

The CELF-P Manual (Wiig et al., 1992) allows for assigning points for dialectally acceptable features of language while scoring individual performances. This allowance, however, seems to be wider in some subtests (e.g., Formulating Labels and Formulating Sentences), where children produce their own utterances, and narrower in other subtests (e.g., Recalling Sentences, Word Structure), where children are either provided with ready utterances,

which they are required to recall, or, where specific language features of standard English are targeted (e.g., the presence of 'are' in constructions such as *The children are playing*).

The Recalling Sentences subtest seemed linguistically biased against tested children as it consists of syntactically complex structures with modifiers that are not common among the studied community. The CELF-P Examiner's manual (Wiig et al., 1992) allows for scoring as acceptable some common regional substitutions, such as use of 'out' instead of 'outside' and 'ma' instead of 'mum'. Such allowance, however, could not be made in relation to the following examples in which many children changed the gist of the stimulus sentences into a more linguistically familiar form to them.

Stimulus sentence:

If you eat everything up you can have pudding too

Children's production (example):

If you eat that burger I will give you ice cream

Stimulus sentence:

You won't grow tall if you don't eat

Children's production (example):

If you want to grow up you have to eat

It is worth noting that the sentences the children created (as versions of stimulus sentences) were *not* shorter in length and were *not* less syntactically complex (they contained at least 2 clauses). However, they could not have been assigned the highest score and in some instances they could not have been assigned any score at all.

Standardised tests are static in nature and thus that they require good meta-linguistic skills. Chaney (2000) argues that literacy difficulties of children living in socio-economically disadvantaged areas are largely rooted in their weaker meta-linguistic skills. Potentially weaker meta-linguistic skills of children participating in this study might have impacted on scores of for example the Word Structure subtest, which relates to the area of morphology. In this subtest children are given a picture stimulus and a verbal elicitation *Here is one bus and here are two* (children are expected to respond *buses*). During the assessment of irregular plural with elicitation *Here is one child and here are two* a huge percentage of children responded *childs,* although the same children were observed to use the word *children* accurately in dynamic situations. Another example was elicitation *This bike is his and this bike is* (children are expected to respond *hers*). One child consistently provided nominative pronouns (i.e. she, he, they, etc.) for any elicitations of genitive or accusative pronouns (i.e. her, his, hers, him, etc.). Particular attention was paid to his use of pronouns in classroom and he was recorded consistently saying them correctly (e.g., *That was his da).*

Standardised language assessment of children participating in this study revealed that some elements of the currently most widely used by Irish SLTs test for language assessment, namely Clinical Evaluation of Language Fundamentals (CELF), might be partly linguistically biased for use with children from

designated disadvantaged communities. Although a part of CELF-P and CELF-3UK normative samples consisted of children from diverse groups, culturally and linguistically (by both race/ethnicity and socioeconomic status), middle class children created the majority of the samples (Wiig et al., 1992, p. 82-84; Semel et al., 2000, p. 16-18). It is recommended that speech and language therapists assessing the language of socio-economically disadvantaged children in Ireland, as well as future researchers studying the language of children in DEIS schools with the use of CELF, assess productive syntax and word knowledge of these children also in a dynamic situation, to complement the results of the Recalling Sentences and Word Structure subtest of CELF.

6.3.6 Ancillary Implications

Identification of children with speech and language difficulties in DEIS schools

International children for whom English was an additional language were often included in the group of children with speech and language difficulties. Indeed, many of them would benefit from additional 'focus on language'. However, not being fluent in a non-native language does not automatically mean a presence of speech and language difficulty. It is estimated that between 10 to 12 per cent of children in Irish classrooms are EAL (DEIS, 2010b). This has implications for community-based SLT services in Ireland that experience large shortages of therapists in some areas. Two children identified by their teachers as experiencing speech and language difficulties (namely children A3 and H2) presented at a norm-referenced assessment at the start of the study with language levels that were exceptional, i.e. above the norms for their age. Both of these

children were observed to be unengaged in the classroom discourse. One of the possible reasons of this disengagement might have been that they were unchallenged. The proposal by DES teacher education in language (DES, 2010b) should include elements related to the SLT referral in order to equip the teachers with the knowledge needed to identify and prioritise children's language difficulties.

6.4 Conclusion

The results of this study, which sought to address the question whether or not a classroom sound field amplification system could play a causal role in a system of elements that contribute to language development of the studied children, suggest that this intervention benefited junior infants to a greater extent than the older study participants (i.e. senior infants and first classes). This conclusion is based on the findings relating to 4 language dimensions studied, namely receptive vocabulary, expressive vocabulary, grammatical correctness and pragmatic appropriateness, upon which a majority of the children who showed gains were junior infants. The finding of a tendency for greater gains in younger participants, consistent with some previous SFA reports studying the efficacy of this intervention across a few grade levels (Flexer, 1989; 1992; Ray, 1992; Rosenberg et al., 1999), highlights a particular need for a favourable classroom acoustics in junior infant classes. There is currently a lack of acoustic guidelines for classroom design in Ireland, together with a limited research base on the listening conditions in early childhood education settings.

This study showed that, if used appropriately, sound field amplification system supports classroom participation (gains were observed in 9 out of 14 classes) and comprehension in the classroom (as measured by norm-referenced receptive language scores; gains were observed in 6 out of 8 classes), regardless of age level. Interestingly, this intervention was shown to particularly benefit the comprehension of children with receptive language delay at baseline, thus indicating an absence of an effect frequently observed in language studies, namely the Matthew effect, i.e. a phenomenon of accumulated advantage (Merton, 1968). As many as 65 per cent of pupils who presented with a receptive language delay at baseline gained in norm-referenced receptive language, with 36 per cent of them making large gains, i.e. gains of 8 or more standardised scores, which is approximately two confidence intervals in the CELF test that was used in the study. This finding is significant when discussed in the context of the findings of several studies in the speech and language therapy (SLT) literature that indicate a low success rate of SLT interventions targeting receptive language (Law et al., 2004). Sound field amplification system supports comprehension in a naturalistic setting and may thus contribute to the development of receptive language skills in a more potent way than some short-term targeted interventions.

Another group of children with specific characteristics, apart from children with a receptive language delay at baseline, who particularly benefited from this intervention, were children who were suspected by their teachers to experience potential undetected hearing difficulties. Very clear gains in ABAB design in responsiveness were noted for two study participants potentially experiencing such difficulties. Another significant finding in the context of

educational disadvantage in Ireland, where the teachers teaching in DEIS schools report a prevalence of both attention and language difficulties (Downes, 2004; Downes & Maunsell, 2007), is that children with teacher-attributed attention difficulties in this study showed a tendency to derive greater benefits from the intervention than their classroom peers without such difficulties, for instance, there were 3 classes (classes C, J, F) in which mostly or only these children showed gains. These findings gain further significance when examined together with the baseline data of this study which revealed language and attention needs of the studied children as significant concern, with 57 per cent of children exhibiting language levels at 2 or below 2 standard deviations below the normative range, and as many as 38 per cent of those identified as language delayed experiencing at the same time attention difficulties. Classroom sound field amplification represents an example of an intervention that potentially targets both areas of difficulty, as it may support language learning by purportedly improving 'on task' behaviour in the classroom.

Overall, the results of the study showed that the effect of the classroom sound field amplification is 'constructed', rather than simply 'a given', with constructions occurring at both the individual child's system level and the class level, with teachers being the agents of the construction in the latter case. The child's family situation, pattern of in-school attendance and the quality of language teaching, together with the classroom climate, were observed to impact upon the efficacy of this intervention. This conclusion, based on a systems theory approach, has implications for the implementation of other non-systemic interventions in the education system and for the process of exploration of how to intervene more effectively in the education system. It highlights the need for

certain background conditions necessary for interventions 'to work' in complex systems. This study found large differences in the quality of language teaching among the observed teachers, thus highlighting the need for professional development of teachers teaching in early education settings.

While this study was conducted in a specific context of urban DEIS schools, with a specific population of early primary school children and in a specific classroom context of whole class teaching lessons, it brings a contribution to both the Irish and international SFA literature at a number of levels. Firstly, it introduces large-scale SFA research into Irish mainstream schools. Secondly, internationally, it introduces a context of relevance of SFA for educational disadvantage and a multidimensional refined notion of language, as well as a new research paradigm in the current large but somewhat underdeveloped body of research on SFA. This new research paradigm, based in a systems theory approach, combined the observations of language behaviours in a naturalistic setting with the observations of the context and the process of interactions in the classroom. Stemming from this systemic approach is the recommendation for further SFA studies that shift a focus from whether or not SFA is beneficial to how it can be used effectively in the classroom. One can view the SFA research as only one part of a large body of international research concerned with classroom acoustics and the impact of noise in the classroom. While this research area is large internationally, it has remained somewhat neglected in the Irish early childhood literature. This study calls for it to be addressed.

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Appendix A

Criteria for Coding Questions

'A question' was coded if it met *each* of the following criteria:

1. It elicited verbal response:

As there are different methods of eliciting responses from pupils in classrooms and some of them do not require verbal activity (such as pointing) (Stubbs, 1993, p. 62), only questions that elicited *verbal* responses were coded. Thus, utterances such as *who has ever been to the beach* or *who has a pet at home* were not coded unless the teacher added *and can tell us a bit about it.* Questions with *who can show me/us* were not coded since *show* may solicit a nonverbal response.

2. It elicited information:

Only questions that solicit information and not the ones that solicit acknowledgement were coded. Acknowledgement soliciting utterances occur when there is a general awareness that a child has already the knowledge (Bishop et al., 2000), e.g., *did you go to the zoo/oh I am sure you had a great time/didn't you* or *is that a nice thing to say.* Acknowledgement soliciting utterances are often utterances that solicit yes/no answers. Following this recognition, interrogative utterances soliciting acknowledgment that were posed to the whole class but could have been answered with yes/no were not coded, e.g., *he looks sad here doesn't he.*

3. It *was not* followed immediately by the teacher's response:

Although most teacher questions invited the children to participate, some were answered by the teacher herself/himself and were posed only to guide the children's comprehension, e.g., *so do you know what happened next/look/ they just became friends.* Such questions were not coded.

4. It *did not* elicit the exact same information as the preceded coded question:

Besides fundamental questions posed by the teacher, there could be a number of repetitions of questions, reformulations of questions, answer guidance utterances and replacements of questions (Scarth & Hammersley, 1986, p. 72). Repeated questions, even rephrased during clarification, were not coded again and were marked *(I)*), as in the following examples *((A)* – coded question):

What are they all/Tesco, Aldi, etc. What is the name (A)/ I will give you a clue/A shop that sells food (/)

W*hat country except Africa the elephants come from* (A)*/ I will give you a clue it begins with I(/)*

What did we put into the bowl when we were making Ginger bread men (A)/ We put something that looked like pepper/ what was it (/)

Furthermore, the following criteria were applied:

1. Interrogation of form was not used as a criterion for coding questions, as there could be some interrogative in form utterances that are declarative or imperative in intent, e.g., *what's going on here* (Heath, 1986, p. 124).
2. Procedural and disciplinary interrogative utterances (Scarth & Hammersley, 1986) were not coded if they were directed to individual children, e.g., *why did you leave the room*, but such interrogative utterances were coded if they solicited verbal response and were directed to the whole class, e.g., *what did we do last week* (Scarth & Hammersley, 1986, p. 73).
3. Questions with *can you think, can you remember* or *do you know* were presumed to elicit verbal response if they asked for specific information (e.g., *do you know anything about this story, can you think about other ways you could escape from the Gruffallo, can you remember what we did yesterday).* Such questions were not coded only if they did not ask for specific information and could have been answered with yes/no, e.g. *do you know this story* or *can you remember this story.*

4. General encouragements to contribute to the classroom discourse that were not preceded by questions eliciting information, such as *put your hand up if you want to say something* were not coded.
5. Although not all interrogative utterances were coded as questions, utterances that did not have interrogative form were not coded even though some of them might elicit language in some children, e.g., *I want you to think about different foods that are good for you, I wonder what happens next*. If such utterances were followed with *who knows any, who can tell us about this, what do you think,* etc. then they were coded, e.g., *I wonder what happens next/who has got any idea.*
6. Rhetorical questions were not coded
7. Introduction of news time, such as *who has got any news today,* was coded as one question. News time complicates the transparency of a relationship between the teacher's elicitations and the number of the children's contributions. The children's contributions are not restricted by topic during news time and the number of contributions, both invited and spontaneous ones, increases.

Appendix B

Age of the Study Participants

Chronological age of individual participants at the beginning and the end of classroom observations (i.e. during the first and the last recording)

	Age Beginning In months	**Age End** In months	**Observation Duration** In months
Junior infants			
B5	52	61	9
B3	60	69	9
B4	47	56	9
B1	49	58	9
B6	56	65	9
B2	53	62	9
E5	58	67	9
E1	58	67	9
E4	50	59	9
E2	50	59	9
E3	59	68	9
C3	50	58	8
C1	50	58	8
C4	61	69	8
C2	53	61	8
J4	51	59	8
J2	58	66	8
J3	53	61	8
J1	50	58	8
J5	50	58	8
H4	57	64	7
H2	61	69	7
H1	55	62	7
H3	61	68	7
N5	69	77	8
N4	61	69	8
N2	57	65	8
N3	60	68	8
N1	66	74	8

Senior infants			
L3	60	73	13
L4	56	69	13
L1	63	76	13
L2	62	75	13
A1	67	80	13
A2	67	80	13
A3	61	74	13
A4	64	77	13
A5	56	69	13
D3	71	79	8
D2	64	72	8
D4	60	68	8
D1	59	67	8
M1	69	77	8
M2	75	83	8
M3	73	81	8
M4	75	83	8
First class			
F1	70	79	9
F3	95	104	9
F2	84	93	9
F4	85	94	9
O3	79	88	9
O2	76	85	9
O1	77	86	9
O4	74	83	9
K4	78	86	8
K5	75	83	8
K2	75	83	8
K3	72	80	8
K1	80	88	8
G4	91	99	8
G3	82	90	8
G1	84	92	8
G2	91	99	8

Appendix C

Number of Utterances

The number of utterances produced by each study participant in each study phase

Child code	A Baseline	B1 Intervention phase 1	B2 Intervention phase 2	B3 Intervention phase 3
Junior infants				
B5	31	39	41	
B3	27	30	53	
B4	20	36	45	
B1	43	65	66	
B6	33	37	42	
B2	50	67	52	
E5	20	55	52	43
E1	34	66	70	42
E4	24	33	30	22
E2	24	37	38	31
E3	42	62	52	52
C3	19	82	38	
C1	18	69	51	
C4	27	96	68	
C2	20	77	65	
J4	29	96	32	
J2	41	99	42	
J3	27	51	22	
J1	31	113	46	
J5	31	41	29	
H4	45	37	45	
H2	25	32	47	
H1	40	28	41	
N5	83	72	194	
N4	91	83	62	
N2	78	120	66	
N3	69	80	55	
N1	63	90	73	
Senior infants				
L3	38	48	81	
L4	28	29	57	
L1	35	38	78	
L2	48	41	36	
A1	25	52	50	55

A2	17	56	65	35	
A3	22	79	44	46	
A4	21	72	63	36	
A5	46	116	109	91	
D3	28	44	71	58	54
D2	41	39	76	44	28
D4	80	89	111	59	44
D1	23	57	66	51	34
M1	52	108	108		
M2	24	37	33		
M3	26	52	23		
M4	42	29	57		
First class					
F1	44	71	34	45	
F3	38	36	42	26	
F2	21	26	29	23	
F4	38	34	38	36	
O3	33	50	79		
O2	34	33	97		
O1	36	47	88		
O4	27	70	191		
K4	32	33			
K5	21	25	54		
K2	17	24	34		
K3	24	31	40		
K1	32	42	48		
G4	40	35	41		
G3	38	23	27		
G1	42	21	49		
G2	35	31	54		

Appendix D

Number of Clause Utterances

The number of clause utterances produced by each study participant in each study phase

	A Baseline	**B1** Intervention phase 1	**B2** Intervention phase 2	**B3** Intervention phase 3	**B4** Intervention phase 4
Junior infants					
B5	0	23	39		
B3	27	26	44		
B4	12	25	38		
B1	29	54	55		
B6	26	33	30		
B2	35	52	52		
E5	0	20	44	37	
E1	28	31	55	30	
E4	18	15	29	21	
E2	20	18	36	30	
E3	36	26	37	41	
C3	0	36	32		
C1	0	22	31		
C4	23	28	38		
C2	19	27	47		
J4	28	27	26		
J2	33	35	32		
J3	19	24	21		
J1	27	32	39		
J5	26	20	28		
H4	36	26	37		
H2	24	27	42		
H1	31	24	29		
N5	79	59	184		
N4	85	77	59		
N2	71	104	65		
N3	63	80	54		
N1	60	88	77		
Senior infants					
L3	29	29	47		
L4	21	0	27		
L1	23	28	37		
L2	31	30	23		

A1	22	30	36	34	
A2	0	25	44	26	
A3	19	35	29	33	
A4	21	39	41	30	
A5	25	29	45	44	
D3	23	28	30	36	30
D2	25	26	39	33	26
D4	56	65	66	36	42
D1	19	33	42	45	27
M1	33	43	49		
M2	21	27	31		
M3	21	23	22		
M4	25	23	30		
First class					
F1	43	57	32	36	
F3	36	32	41	26	
F2	17	26	27	23	
F4	33	34	35	33	
O3	24	39	75		
O2	26	31	96		
O1	22	33	84		
O4	27	49	189		
K4	30	28			
K5	13	23	54		
K2	0	24	31		
K3	20	27	39		
K1	25	29	47		
G4	31	27	41		
G3	26	15	26		
G1	26	15	41		
G2	25	22	48		

Appendix E

Proportion of Word Level Utterances

Proportion of word level utterances[162] in all utterances for each study participant in each study phase

	A Baseline	B1 Intervention phase 1	B2 Intervention phase 2	B3 Intervention phase 3
Junior infants				
B5	0.05	0.00	0.00	
B3	0.06	0.00	0.00	
B4	0.00	0.00	0.00	
B1	0.00	0.00	0.00	
B6	0.00	0.00	0.00	
B2	0.03	0.00	0.00	
E5	0.20	0.11	0.05	0.00
E1	0.04	0.04	0.00	0.03
E4	0.00	0.04	0.00	0.09
E2	0.10	0.00	0.04	0.00
E3	0.03	0.02	0.04	0.00
C3	0.00	0.03	0.07	
C1	0.13	0.02	0.02	
C4	0.00	0.03	0.07	
C2	0.00	0.06	0.00	
J4	0.00	0.07	0.13	
J2	0.03	0.08	0.13	
J3	0.00	0.05	0.27	
J1	0.00	0.05	0.06	
J5	0.05	0.03	0.16	
H4	0.20	0.19	0.00	
H2	0.47	0.18	0.03	
H1	0.10	0.17	0.00	
N5	0.00	0.00	0.01	
N4	0.00	0.01	0.00	
N2	0.03	0.00	0.00	
N3	0.04	0.00	0.00	
N1	0.00	0.01	0.00	
Senior infants				
L3	0.00	0.03	0.01	
L4	0.00	0.05	0.06	

[162] See chapter three for the definition of a word level utterance

L1	0.00	0.04	0.07	
L2	0.03	0.13	0.15	
A1	0.13	0.00	0.00	0.02
A2	0.29	0.00	0.00	0.00
A3	0.22	0.01	0.06	0.03
A4	0.27	0.02	0.00	0.00
A5	0.03	0.02	0.00	0.01
D3	0.00	0.00	0.23	0.21
D2	0.00	0.03	0.12	0.15
D4	0.09	0.01	0.13	0.18
D1	0.11	0.00	0.25	0.02
M1	0.26	0.30	0.38	
M2	0.21	0.22	0.04	
M3	0.06	0.21	0.42	
M4	0.19	0.11	0.55	
First class				
F1	0.00	0.05	0.00	0.03
F3	0.07	0.00	0.05	0.06
F2	0.14	0.13	0.00	0.08
F4	0.00	0.00	0.00	0.03
O3	0.48	0.05	0.04	
O2	0.13	0.04	0.00	
O1	0.15	0.14	0.03	
O4	0.00	0.17	0.00	
K4	0.27	0.00	0.00	
K5	0.00	0.13	0.53	
K2	0.71	0.14	0.36	
K3	0.30	0.14	0.21	
K1	0.40	0.41	0.00	
G4	0.07	0.16	0.24	
G3	0.04	0.20	0.00	
G1	0.09	0.60	0.00	
G2	0.04	0.24	0.04	

Appendix F

Number of Teacher Obligations

Mean number of teacher obligations directed to individual study participants in each study phase

	A Baseline	B1 Intervention phase 1	B2 Intervention phase 2	B3 Intervention phase 3
Junior infants				
B5	4.80	6.80	3.60	
B3	5.00	4.30	4.20	
B4	0.70	3.00	4.20	
B1	5.30	3.00	1.20	
B6	4.00	6.30	3.30	
B2	3.80	3.20	3.20	
E5	1.70	7.00	8.00	5.50
E1	1.30	6.00	4.00	1.80
E4	3.00	5.70	6.00	2.50
E2	1.70	2.80	4.30	1.80
E3	1.00	3.30	11.00	4.00
C3	1.00	9.50	6.00	
C1	1.80	11.00	7.80	
C4	2.00	14.70	12.30	
C2	1.40	12.80	9.80	
J4	0.50	7.80	4.50	
J2	2.80	9.50	1.50	
J3	1.50	5.50	3.00	
J1	1.80	8.30	5.50	
J5	1.80	5.30	6.00	
H4	4.30	1.80	4.80	
H2	2.80	3.30	2.50	
H1	4.50	4.00	6.00	
N5	9.30	16.00	26.00	
N4	18.30	11.00	17.00	
N2	10.00	6.30	14.00	
N3	7.70	7.70	12.00	
N1	8.30	15.70	19.00	
Senior infants				
L3	7.70	8.00	13.00	
L4	6.00	4.50	8.40	
L1	8.30	6.00	14.80	
L2	7.00	5.00	6.70	

A1	4.70	9.30	6.80	8.80
A2	1.30	9.30	7.00	4.30
A3	1.70	13.00	6.30	7.80
A4	2.70	13.50	10.80	5.30
A5	9.00	20.00	17.80	11.80
D3	4.00	9.70	13.30	9.00
D2	7.00	7.30	11.00	2.00
D4	6.70	5.70	9.00	2.80
D1	1.00	6.00	7.70	2.70
M1	4.80	11.80	11.80	
M2	4.00	7.00	7.30	
M3	5.00	11.30	4.50	
M4	6.50	5.00	13.70	
First class				
F1	3.70	3.30	2.50	7.70
F3	4.00	3.00	7.00	2.70
F2	2.50	2.30	2.00	2.50
F4	6.00	2.30	3.50	5.00
O3	4.30	8.00	9.00	
O2	5.30	2.30	13.80	
O1	7.00	17.00	18.30	
O4	2.00	8.50	12.80	
K4	3.00	2.30		
K5	0.00	4.30	8.70	
K2	1.30	5.00	1.00	
K3	1.00	1.50	3.00	
K1	3.30	0.00	0.00	
G4	4.00	5.00	4.30	
G3	5.50	0.30	1.30	
G1	8.30	1.70	5.30	
G2	4.50	4.70	7.30	

Appendix G

Index of Teacher Attention

Index of teacher attention to individual study participants in each study phase: Relationship of the teacher's obligations to individual children to the teacher's questions to the whole class (proportion)

	A Baseline	A Baseline	A Baseline	B1 Intervention phase 1	B1 Intervention phase 1	B1 Intervention phase 1	B2 Intervention phase 2	B2 Intervention phase 2	B2 Intervention phase 2	B3 Intervention phase 3	B3 Intervention phase 3	B3 Intervention phase 3	B4 Intervention phase 4	B4 Intervention phase 4	B4 Intervention phase 4
Child code	Questions to the whole class	Obligations to the child	Proportion	Questions to the whole class	Obligations to the child	Proportion	Questions to the whole class	Obligations to the child	Proportion	Questions to the whole class	Obligations to the child	Proportion	Questions to the whole class	Obligations to the child	Proportion
B5	34	19	0.56	63	27	0.43	54	18	0.33						
B3	34	15	0.44	63	13	0.21	54	21	0.39						
B4	34	2	0.06	63	15	0.24	54	21	0.39						
B1	34	21	0.62	63	15	0.24	54	6	0.11						
B6	34	16	0.47	63	19	0.30	54	13	0.24						
B2	34	15	0.44	63	16	0.25	54	16	0.30						
E5	18	5	0.28	25	28	1.12	17	24	1.41	32	22	0.69			
E1	18	4	0.22	25	24	0.96	17	12	0.71	32	7	0.22			
E4	18	6	0.33	25	17	0.68	17	18	1.06	32	10	0.31			
E2	18	5	0.28	25	11	0.44	17	13	0.76	32	7	0.22			
E3	18	3	0.17	25	13	0.52	17	22	1.29	32	16	0.50			
C3	45	5	0.11	44	38	0.86	42	18	0.43						
C1	45	7	0.16	44	44	1.00	42	31	0.74						
C4	45	6	0.13	44	44	1.00	42	49	1.17						
C2	45	7	0.16	44	51	1.16	42	39	0.93						
J4	66	2	0.03	47	31	0.66	61	9	0.15						
J2	66	11	0.17	47	38	0.81	61	3	0.05						
J3	66	6	0.09	47	22	0.47	61	6	0.10						

J1	66	7	0.11	47	33	0.70
J5	66	7	0.11	47	16	0.34
H4	33	17	0.52	43	7	0.16
H2	33	11	0.33	43	13	0.30
H1	33	18	0.55	43	8	0.19
N5	48	28	0.58	72	32	0.44
N4	48	55	1.15	72	33	0.46
N2	48	30	0.63	72	19	0.26
N3	48	23	0.48	72	23	0.32
N1	48	25	0.52	72	47	0.65
Senior infants						
L3	19	23	1.21	32	32	1.00
L4	19	18	0.95	32	18	0.56
L1	19	25	1.32	32	24	0.75
L2	19	21	1.11	32	15	0.47
A1	29	14	0.48	62	37	0.60
A2	29	4	0.14	62	37	0.60
A3	29	5	0.17	62	52	0.84
A4	29	8	0.28	62	54	0.87
A5	29	27	0.93	62	80	1.29
D3	46	16	0.35	28	29	1.04
D2	46	28	0.61	28	22	0.79
D4	46	20	0.43	28	17	0.61
D1	46	4	0.09	28	18	0.64
M1	48	19	0.40	35	47	1.34
M2	48	12	0.25	35	21	0.60
M3	48	15	0.31	35	34	0.97
M4	48	26	0.54	35	15	0.43
First class						
F1	35	11	0.31	41	13	0.32
F3	35	12	0.34	41	12	0.29
F2	35	5	0.14	41	7	0.17
F4	35	12	0.34	41	7	0.17

0.18						
0.20						
0.28						
0.15						
0.35						
1.24						
0.81						
0.67						
0.57						
0.90						
1.30						
0.84						
1.18						
0.40						
0.50	44	35	0.80			
0.52	44	17	0.39			
0.35	44	31	0.70			
0.80	44	21	0.48			
1.31	44	47	1.07			
0.79	46	36	0.78	50	47	1.06
0.66	46	8	0.17	21	47	0.45
0.54	46	11	0.24	2	21	0.10
0.34	46	8	0.17	4	47	0.09
1.62						
0.76						
0.31						
1.41						
0.23	32	7	0.22			
0.64	32	8	0.25			
0.18	32	10	0.31			
0.32	32	20	0.63			

O3	24	13	0.54	37	24	0.65	36	36	1.00
O2	24	16	0.67	37	7	0.19	36	55	1.53
O1	24	21	0.88	37	34	0.92	36	55	1.53
O4	24	4	0.17	37	17	0.46	36	51	1.42
K4	25	9	0.36	31	7	0.23			
K5	25	0	0.00	31	13	0.42	45	26	0.58
K2	25	4	0.16	31	10	0.32	45	3	0.07
K3	25	2	0.08	31	5	0.16	45	9	0.20
K1	25	10	0.40	31	0	0.00	45	0	0.00
G4	63	16	0.25	43	15	0.35	51	13	0.25
G3	63	22	0.35	43	1	0.02	51	4	0.08
G1	63	25	0.40	43	5	0.12	51	16	0.31
G2	63	18	0.29	43	14	0.33	51	22	0.43

Appendix H

Description of the Clinical Evaluation of Language Fundamentals (CELF)

Receptive language subtests of the CELF were the following:

Linguistic Concepts (CELF-P) and **Concepts and Directions** (CELF-P2 and CELF-3UK) subtests assess the ability to comprehend oral directions of varying length containing linguistic concepts and quantifiers, i.e. concepts of coordination (e.g., *and*), inclusion/exclusion (e.g., *either/all*), temporal relation/order (e.g., after), spatial (e.g., *next to*) and quantitative concepts (e.g., *all except*).

Basic Concepts (CELF-P) subtest assesses the understanding of modifiers, i.e. modifiers of attribution (e.g., *cold, slow*), dimension/size (e.g., *tall, large*), equality (e.g., *same, different*), number/quantity (e.g., *empty, many*) and direction/location/position (e.g., *first, at the bottom*).

Sentence Structure (CELF-P, CELF-P2 and CELF-3UK) subtest assesses the comprehension of spoken sentences of increasing length and structural complexity, e.g., sentences with verb phrase (e.g., *The boy is running*), indirect object (e.g., *I showed him the mouse*) or modification (e.g., *The red balloon is on the sofa*).

Word Classes (CELF-P2 and CELF-3UK) subtest assesses the ability to perceive relationships between words that are categorised by part-whole relations (*button/shirt*), semantic class features (*cup/plate*), synonyms (*cross/angry*) and antonyms (*sick/healthy*) (Semel et al., 2000, p. 72).

Expressive language subtests of the CELF were the following:

Recalling Sentences in Context (CELF-P) and **Recalling Sentences** (CELF-P2 and CELF-3UK) subtests assess the ability to repeat sentences of increasing length and complexity verbatim, e.g., simple sentences (e.g., *I can do this*), complex sentences (e.g., *Can we open it and play*), imperative sentences (e.g., *Look over there*) and interrogative sentences (e.g., *Where is he going to*).

Formulating Labels (CELF-P), **Expressive Vocabulary** (CELF-P2) subtests assess the ability to label actions (verbs) and objects (nouns) in pictures (vocabulary).

Formulated Sentences (CELF-3UK) subtest assesses the ability to create sentences to pictures with given words (e.g., with words: *children, before, either, however*).

Word Structure (CELF-P, CELF-P2 and CELF-3UK) subtest assesses the use of grammatical markers such as verb tense (e.g., third person singular –s, regular past tense –ed, etc.), plurals (-s), possession (-s) and pronouns (e.g., he, him, his, himself).

Description of CELF-Preschool, CELF-Preschool 2 and CELF-3UK subtests (Wiig et al., 2004, p. 4)

Subtest of CELF-Preschool 2	Task Performed
Sentence Structure	The child points to pictures in the Stimulus Book in response to oral directions.
Word Structure	The child completes a sentence (cloze procedure) with the targeted structure(s).
Expressive Vocabulary	The child identifies an object, person, or activity portrayed in the Stimulus Book.
Concepts and Following Directions	The child points to pictures in the Stimulus Book in response to oral directions
Recalling Sentences	The child imitates sentences presented by the examiner.
Basic Concepts[163]	The child points to a picture that illustrates the targeted concept.
Word Classes	The child chooses the two words that are related and describes the relationship.

Subtest of CELF-Preschool	Task Performed
Sentence Structure	The child points to pictures in the Stimulus Book in response to oral directions
Word Structure	The child completes a sentence (cloze procedure) with the targeted structure(s).

[163] Basic Concepts subtests is administered to children in the age range 3-4 only

Formulating Labels	The child identifies an object, person, or activity portrayed in the Stimulus Book.
Linguistic Concepts	The child points to pictures in the Stimulus Book in response to oral directions
Recalling Sentences in Concepts	The child imitates sentences from a story.
Basic Concepts	The child points to a picture that illustrates the targeted concept.

Subtest of CELF-3UK	Task Performed
Sentence Structure	The child points to pictures in the Stimulus Book in response to oral directions
Word Structure	The child completes a sentence (cloze procedure) with the targeted structure(s).
Formulated Sentences	The child creates sentences with given words about pictures in the Stimulus Book.
Concepts and Directions	The child points to shapes in the Stimulus Book in response to oral directions.
Recalling Sentences	The child imitates sentences presented by the examiner.
Word Classes	The child chooses the two words that are related.

Appendix I

Details of CELF-P and CELF-P2 correlation

The CELF-P2 differs from the CELF-P in the following (Wiig et al., 2004, p. 90):

1. The CELF-P2 whole test administration may be shorter as the CELF-P2 introduces the concept of Core Language

The CELF-P2 Examiner's Manual (Wiig et al., 2004) reports that the time administration required for the Core Language subtest is 15-20 minutes, depending on the child's age and responsiveness. Administration time may, however, be longer if a child presents with some language difficulties and further assessment is needed. The CELF-P whole test administration differs depending on the age of the child tested and it ranges from 30-36 minutes for 4.00-6.11 age range (Wiig et al., 1992). In the present study, children were assessed on one component of the test, either receptive or expressive language, at a time. The approximate time for one component, receptive or expressive, would be 15-18 minutes. One may thus conclude that the times of both tests' administration (i.e. CELF-P2 and CELF-P) are comparable.

2. The CELF-P2 evaluates semantic skills through the introduction of Word Classes subtest. The CELF-P features no similar subtest.

The composites of the CELF-P and the CELF-P2 are highly correlated, indicating that both tests measure similar language behaviours (Wiig et al., 2004,

p. 135). Although children may score slightly lower on CELF-P2, the overall clinical decisions (e.g., the severity of language difficulties judged on the basis of a confidence interval) should be consistent between those tests (Wiig et al., 2004).

The CELF-P2 Expressive Vocabulary subtest is correlated with the Formulating Labels subtest of CELF-P (Wiig et al., 2004, p. 134). The CELF-P2 Concepts and Following Directions subtest is correlated with the Linguistic Concepts subtest of the CELF-P (Wiig et al., 2004, p. 134).

Appendix J

Differences between CELF-P and CELF-3UK

- The CELF-P was standardised for ages 3.00-6.11 and the CELF-3 was standardised for ages 6.00-21.11

- The correlation of CELF-Preschool and CELF-3 is not reported but the correlation of CELF-P and CELF-R (which is the American version on which the English version CELF-3UK was modelled) is reported. Total Language Score correlation between CELF-P and CELF-R is 0.86 (Wiig et al., 1992).

- CELF-3 Receptive Language internal consistency reliability coefficient is 0.88. CELF-P Receptive Language internal consistency reliability coefficient is 0.76.

- CELF-3 Receptive Language standard error of measurement is 1.03. CELF-P Receptive Language standard error of measurement is 1.49.

Appendix K

Criteria of Segmentation into Study Phases

The lessons recorded in the intervention phase were segmented into study phases based on the following criteria:

1. The length of exposure to the intervention:

First intervention phase was the phase of on average the first sixteen weeks (SD=2.3, range 11-20) of exposure to intervention for 12 classes. It was lengthened into 35 and 33 weeks in case of two classes (class A and class L), which were recorded for more than one academic year (58 and 55 weeks respectively). It was assumed that the maturation effect did not strongly affect the first phase of the intervention for the remaining twelve classes.

The length of *exposure* to the intervention* for individual classes

Class code	Months
B	8
L	11
F	9
J	8
A	9
O	9
E	9
C	7
H	7
D	8
K	7
M	8
G	7
N	7
MEAN	**8 months**

* This time period does not include summer holidays but it *does* include other breaks within school year, both DES directed (e.g., Easter holiday, term breaks) and other (e.g., teacher's absence, day trips).

2. The wealth of linguistic material available for analysis:

Children provided varying numbers of utterances in each lesson. In order to provide for this variability, the utterances in each phase were firstly summed up and then analysed for each dimension. Performance during individual lessons was not computed (except *participation*, the scores of which were computed for each data point). Some variability in the wealth of linguistic material existed also across study phases.

When the linguistic material available for analysis was significantly poorer in some phases of the study, i.e. by more than a hundred percent, (e.g., 15 utterances in the baseline, 11 utterances in the first phase of the intervention and 2 utterances in the second phase of the intervention), then phases of the study were merged further, i.e. there were then the baseline phase and the intervention phase, instead of the baseline phase, the first intervention phase and the second intervention phase. That was the case for one class only (class G). Such merger was not possible if the material was significantly *wealthier* in some phases of the study and when the differences between the wealth of the material existed between the baseline and the intervention phases. The differences in the wealth of linguistic material available for analysis in each study phase were noted while interpreting the results.

3. The number of recorded sessions:

As scores on each dimension were averaged per phase, the number of sessions recorded per phase (data points) was of least importance in segmenting the linguistic material. However, the number of sessions recorded in each study

phase (data points) was considered during scheduling recordings and it remained comparable across phases, with a mean of 3.5 recordings per phase (range: 2-5, SD=0.74).

Appendix L

Computation Method

Scores were averaged for specified phases of the study in order to compensate for diversity in the wealth of linguistic material obtained in each recording session, diversity of the lesson content and for high variability of language (Kazdin, 1982; Adams et al., 2006). Dimensions were computed on the basis of the total frequency of the targeted linguistic feature/ language behaviour in the specified phase. Scores were not computed individually for each observation. The following is the illustration of the chosen approach with hypothetical figures:

Hypothesised computation of scores

Computation 1: Mean of individual frequencies	Computation 2: Total frequency (Approach adopted in the present study)
Baseline phase: 2 observed lessons (2 data points) 1st lesson: 11 teacher's obligations/3 failures to respond = 27% 2nd lesson: 2 teacher's obligations/1 failure to respond = 50% Average: 39% of failures to respond Responsiveness Score: 0.61	Baseline phase: 2 observed lessons (2 data points) 1st lesson: 11 teacher's obligations/3 failures to respond 2nd lesson: 2 teacher's obligations/1 failure to respond Total: 13 obligations/4 failures to respond = 31% of failures to respond. Responsiveness Score: 0.69

The analysis of dimensions occurred at different levels of linguistic material. For example, *responsiveness* was measured versus all teachers' obligations received and *syntactic complexity* was measured in the total number of sentences. Thus, a high ratio in one category would not influence a low ratio in another category. For instance, if a child failed to respond a number of times, it did not result in a lower number of grammatically incorrect utterances as these were computed in the total number of *verbal* utterances and not in the total number of all response turns.

Appendix M

Loquacity: Individual Scores

Proportion of multi-clause utterances in all utterances for each study participant in each study phase

	A Baseline	**B1** Intervention phase 1	**B2** Intervention phase 2	**B3** Intervention phase 3
Junior infants				
B5				
B3	0.00	0.00	0.13	
B4				
B1	0.00	0.21	0.14	
B6	0.00	0.15	0.17	
B2	0.20	0.25	0.33	
E5				
E1	0.25	0.28	0.29	0.27
E4	0.00	0.14	0.00	0.14
E2	0.00	0.00	0.00	0.14
E3	0.00	0.25	0.25	0.20
C3				
C1				
C4	0.00	0.00	0.00	
C2				
J4	0.00	0.00	0.00	
J2	0.15	0.19	0.00	
J3	0.00	0.00	0.00	
J1	0.14	0.12	0.14	
J5	0.00	0.00	0.00	
H4	0.13	0.33	0.24	
H2	0.06	0.08	0.14	
H1	0.00	0.08	0.00	
N5	0.33	0.11	0.42	
N4	0.28	0.26	0.21	
N2	0.18	0.29	0.17	
N3	0.43	0.43	0.50	
N1	0.27	0.33	0.24	
Senior infants				
L3	0.44	0.22	0.19	
L4	0.18	0.10	0.10	
L1	0.00	0.00	0.10	
L2				
A1	0.00	0.00	0.19	0.50
A2				
A3	0.00	0.06	0.11	0.15
A4				

A5	0.00	0.00	0.00	0.23
D3	0.00	0.00	0.20	0.25
D2	0.00	0.17	0.15	0.85
D4	0.39	0.38	0.37	0.42
D1	0.00	0.00	0.00	0.52
M1	0.31	0.35	0.16	
M2				
M3	0.00	0.00	0.00	
M4	0.20	0.00	0.00	
First class				
F1	0.42	0.43	0.17	0.56
F3	0.25	0.19	0.36	0.38
F2				
F4	0.07	0.09	0.13	0.21
O3	0.25	0.42	0.29	
O2	0.50	0.27	0.26	
O1	0.00	0.25	0.29	
O4	0.30	0.28	0.51	
K4	0.40	0.09	0.10	
K5				
K2				
K3	0.25	0.14	0.18	
K1	0.40	0.60	0.60	
G4	0.27	0.34		
G3	0.20	0.60		
G1	0.17	0.60		
G2	0.40	0.38		

Appendix N

Syntactic Complexity: Individual Scores

Proportion of syntactically complex utterances in all utterances for each study participant in each study phase

	A Baseline	**B1** Intervention phase 1	**B2** Intervention phase 2	**B3** Intervention phase 3
Junior infants				
B5				
B3	0.00	0.00	0.09	
B4				
B1	0.00	0.15	0.08	
B6	0.00	0.00	0.17	
B2	0.06	0.08	0.11	
E5				
E1	0.11	0.14	0.12	0.08
E4	0.00	0.14	0.00	0.14
E2	0.00	0.00	0.00	0.14
E3	0.00	0.14	0.25	0.00
C3				
C1				
C4	0.00	0.00	0.00	
C2				
J4	0.00	0.00	0.00	
J2	0.00	0.13	0.00	
J3	0.00	0.00	0.00	
J1	0.12	0.14	0.12	
J5	0.00	0.00	0.00	
H4	0.06	0.08	0.14	
H2	0.06	0.04	0.14	
H1	0.00	0.25	0.00	
N5	0.09	0.00	0.11	
N4	0.04	0.08	0.10	
N2	0.06	0.21	0.15	
N3	0.11	0.11	0.31	
N1	0.08	0.07	0.13	
Senior infants				
L3	0.00	0.00	0.00	
L4	0.18	0.10	0.00	
L1	0.00	0.00	0.00	
L2				
A1	0.00	0.00	0.06	0.12
A2				
A3	0.00	0.00	0.00	0.08
A4				

A5	0.00	0.00	0.00	0.23
D3	0.00	0.00	0.20	0.25
D2	0.00	0.17	0.10	0.54
D4	0.18	0.17	0.15	0.26
D1	0.00	0.00	0.00	0.30
M1	0.00	0.16	0.06	
M2				
M3	0.00	0.00	0.00	
M4	0.20	0.00	0:00	

First class

F1	0.19	0.17	0.00	0.27
F3	0.11	0.11	0.36	0.25
F2				
F4	0.07	0.00	0.00	0.05
O3	0.25	0.14	0.17	
O2	0.20	0.08	0.09	
O1	0.00	0.25	0.29	
O4	0.30	0.09	0.27	
K4	0.09	0.07	0.00	
K5				
K2				
K3	0.00	0.00	0.00	
K1	0.40	0.14	0.60	
G4	0.00	0.22		
G3	0.20	0.60		
G1	0.00	0.60		
G2	0.00	0.19		

Appendix O

Grammatical Correctness: Individual Scores

Proportion of grammatically correct utterances in all utterances for each study participant in each study phase

	A Baseline	B1 Intervention Phase 1	B2 Intervention phase 2	B3 Intervention phase 3
Junior infants				
B5	0.92	0.89	0.81	
B3	1.00	0.85	0.94	
B4	1.00	0.83	0.85	
B1	0.97	0.96	0.98	
B6	0.95	0.91	0.94	
B2	0.97	0.96	0.98	
E5	1.00	0.96	0.92	0.87
E1	1.00	1.00	0.98	1.00
E4	0.87	0.93	0.87	0.87
E2	0.80	0.96	0.92	0.86
E3	0.93	1.00	1.00	0.82
C3	1.00	1.00	1.00	
C1	0.75	0.89	0.94	
C4	1.00	0.99	0.90	
C2	1.00	0.98	0.94	
J4	0.94	0.94	0.94	
J2	0.97	0.96	0.97	
J3	1.00	0.95	1.00	
J1	0.95	0.98	1.00	
J5	1.00	1.00	1.00	
H4	0.97	0.96	0.89	
H2	1.00	0.92	1.00	
H1	0.80	0.87	0.87	
N5	0.89	0.91	0.96	
N4	0.87	0.83	0.96	
N2	1.00	0.95	0.98	
N3	0.85	0.92	0.90	
N1	0.88	0.87	0.93	
Senior infants				
L3	0.89	1.00	1.00	
L4	0.97	0.97	1.00	
L1	1.00	1.00	1.00	
L2	0.89	0.98	1.00	
A1	1.00	1.00	1.00	1.00
A2	1.00	1.00	0.99	1.00
A3	1.00	1.00	1.00	1.00
A4	0.75	0.98	0.94	1.00

A5	0.96	0.93	0.77	0.82
D3	1.00	0.92	0.93	0.96
D2	0.92	0.92	0.92	0.94
D4	0.96	0.94	0.96	0.96
D1	1.00	0.90	0.95	0.87
M1	1.00	0.96	0.96	
M2	1.00	0.96	1.00	
M3	1.00	0.89	1.00	
M4	0.96	0.94	0.92	
First class				
F1	0.97	0.98	1.00	0.91
F3	1.00	1.00	1.00	1.00
F2	1.00	1.00	1.00	1.00
F4	0.95	1.00	1.00	1.00
O3	1.00	1.00	1.00	
O2	0.90	1.00	0.94	
O1	0.93	0.78	0.92	
O4	1.00	1.00	1.00	
K4	1.00	1.00	1.00	
K5	1.00	1.00	1.00	
K2	1.00	0.91	1.00	
K3	1.00	0.91	0.97	
K1	1.00	1.00	1.00	
G4	1.00	1.00		
G3	1.00	1.00		
G1	1.00	1.00		
G2	1.00	0.95		

Appendix P

Test-retest Performances of Children who were Re-tested by a Different Examiner or with a Different Test Version

Test-retest performances of children who were retested by a different examiner or with a different test version: *Expressive Language*
SS – standardised score

Child Code	SS Pre-Intervention	SS Post-Intervention	Findings
	Expressive Language		
	Children re-assessed by another examiner		
F-B4	79	91	large gain
M-E4	86	105	large gain
M-E1	84	87	gain
M-E2	87	94	gain
	Children re-assessed with a different test version		
M-F2	85	77	decrease
F-F1	86	84	decrease
M-F5	97	83	decrease
M-F4	74	69	decrease
M-M4	78	69	decrease
M-M1	80	81	no change
M-M2	64	69	gain
M-M3	71	69	decrease
M-K4	99	90	decrease
M-K1	92	106	large gain
M-D3	70	69	no change

Test-retest performances of children who were re-tested by a different examiner or with a different test version: *Receptive Language*
SS – standardised score

	Receptive Language		
	Children re-assessed with a different test version		
F-O3	72	81	large gain
F-O2	72	81	large gain
M-O8	84	83	no change
M-O7	74	83	large gain
M-O1	67	74	gain
M-O6	93	92	no change
M-M4	76	74	decrease
M-M1	76	77	no change
M-M2	67	64	decrease
M-M3	93	74	decrease
M-K4	90	86	decrease
M-K1	99	109	large gain
M-D3	64	74	large gain

Appendix R

Sample of a Letter of Parental Consent

Your child is invited to participate in a study that looks at the benefits of the classroom sound field amplification for speech and language. Participation in this project involves video recording language lessons in classrooms approximately two times a month for the duration of one year and two 40-minute standardised assessments of children in a one-to-one setting.

If you give your permission by signing the Consent Form, it is intended that the results will be published at the end of the study. In any publication, information will be provided in such a way that neither you nor your child can be identified. You will have access to the results at the end of the project. You may also request information regarding your child during the duration of the project.

Participation in any research project is voluntary. If you do not wish your child to take part you are not obliged to. If you decide for your child to take part and later change your mind, you are free to withdraw from the project at any stage. By signing below, you freely agree that your child participates in this project.

Signature of a Parent/Guardian

Appendix S

Participation, Responsiveness and Pragmatic Appropriateness: First Classes, Class M and Class N

Table K1.1. Profile: Child K1

Gender	Male
Age at the start of intervention	6 years 8 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	8 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure K3.1. Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

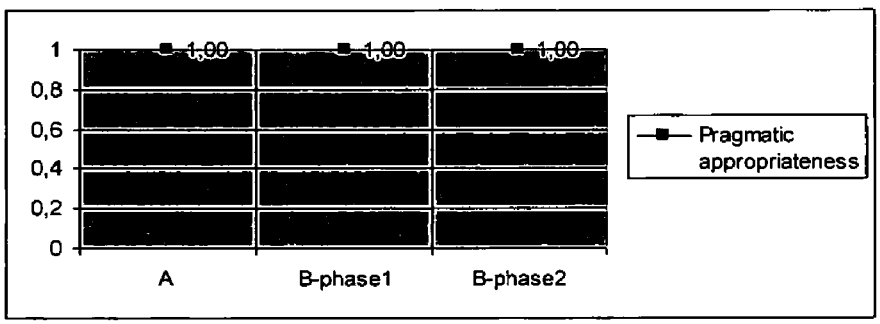


Figure K4.1. Participation pre-intervention (A) and after the introduction of intervention (B)

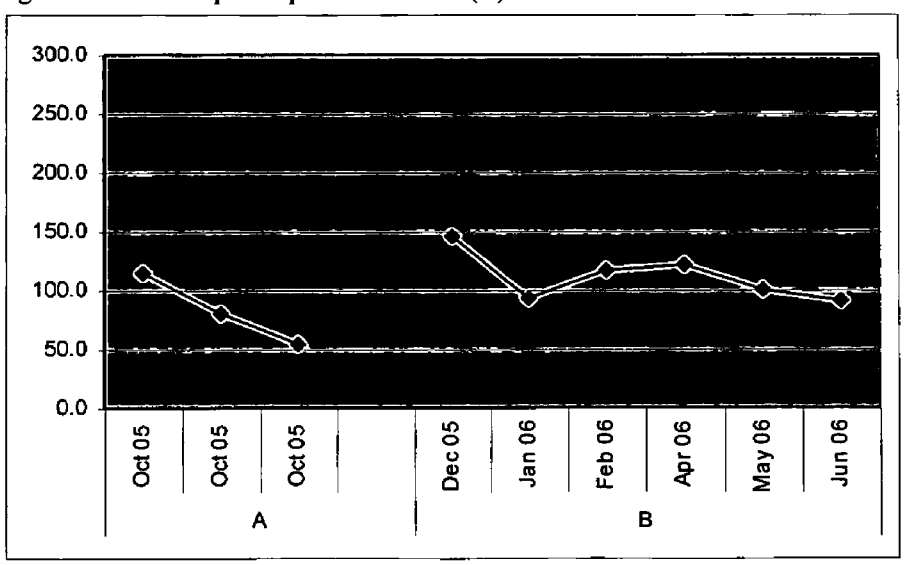


Table K1.2. Profile: Child K2

Gender	Male
Status	International student
Age at the start of intervention	6 years 3 months
Language skills pre-intervention	Severe receptive language disorder Severe expressive language disorder
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	8 months
Teacher's use of microphone	Teacher wore the microphone 4 days out of 6 the researcher arrived

Figure K3.2. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

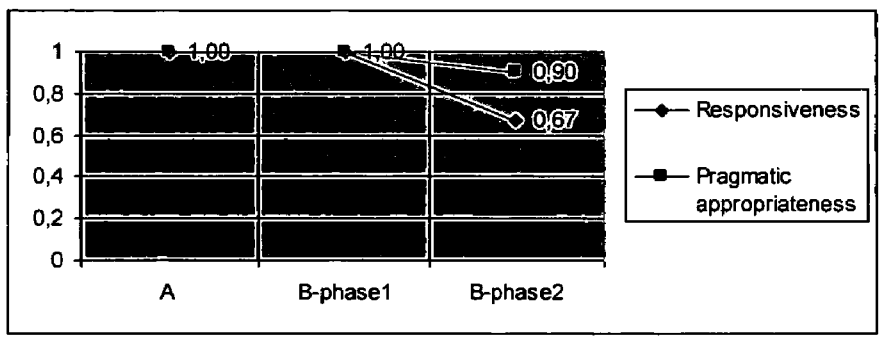


Figure K4.2. Participation pre-intervention (A) and after the introduction of intervention (B)

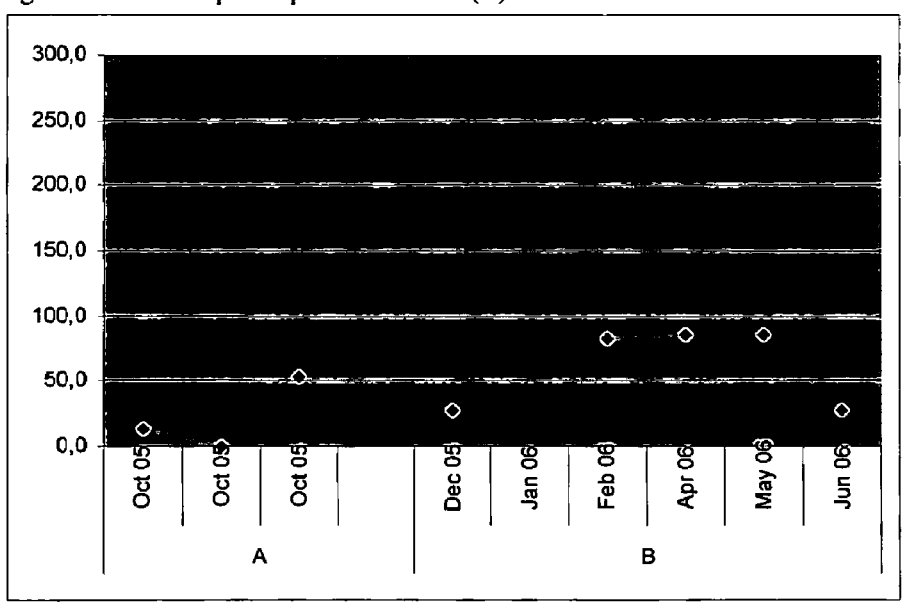


Table K1.3. Profile: Child K3

Gender	Male
Status	He had hearing problems and he underwent grommet microsurgery[164] prior to the start of the intervention. Minor ear infections could occur after grommet microsurgery.
Age at the start of intervention	6 years 2 months
Language skills pre-intervention	Within norms for age receptive language Moderate expressive language impairment
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	8 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure K3.3. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

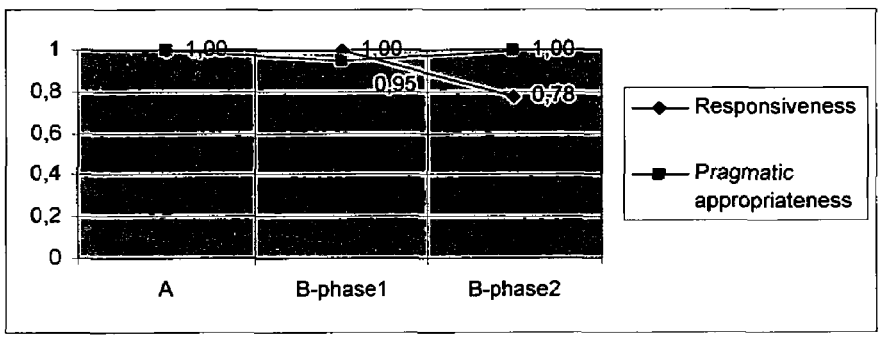
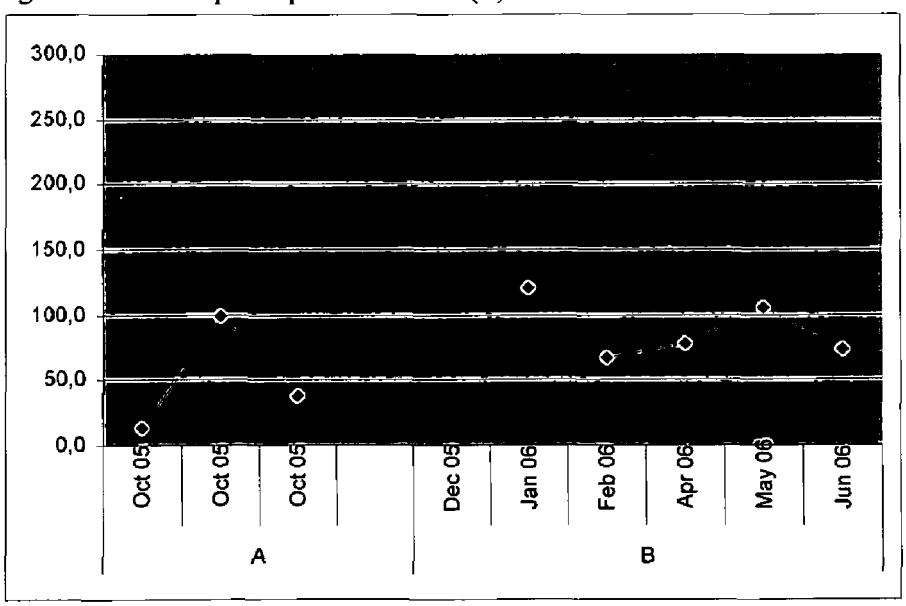


Figure K4.3. Participation pre-intervention (A) and after the introduction of intervention (B)



[164] Grommets are small tubes placed in the eardrum in order to improve the hearing canal.

Table K1.4. Profile: Child K4

Gender	Male
Status	Attention difficulties
Age at the start of intervention	6 years 7 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive 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	8 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 6 the researcher arrived

Figure K3.4. Responsiveness and pre-intervention (A) and after the introduction of intervention (B)

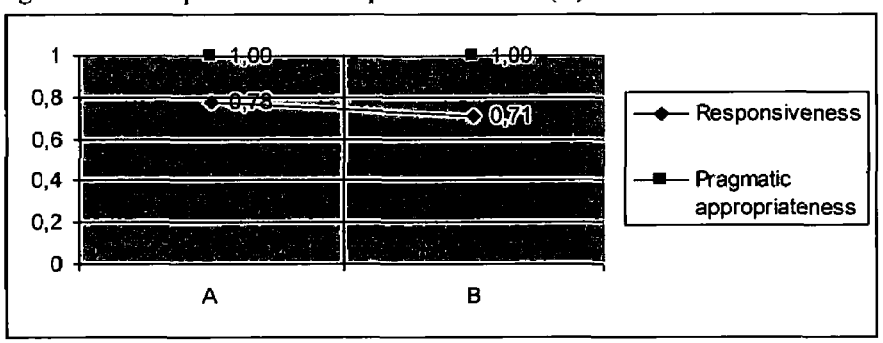


Figure K4.4. Participation pre-intervention (A) and after the introduction of intervention (B)

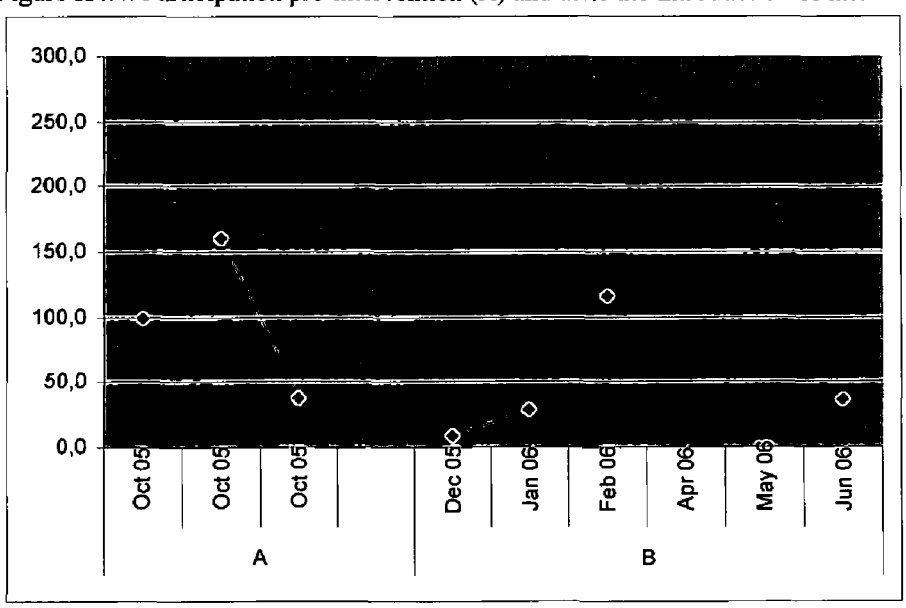


Table K1.5. Profile: Child K5

Gender	Male
Status	International student
Age at the start of intervention	6 years 5 months
Language skills pre-intervention	Severe receptive language disorder Severe expressive language disorder
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	8 months
Teacher's use of microphone	Teacher wore the microphone 4 days out of 6 the researcher arrived

Figure K3.5. Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

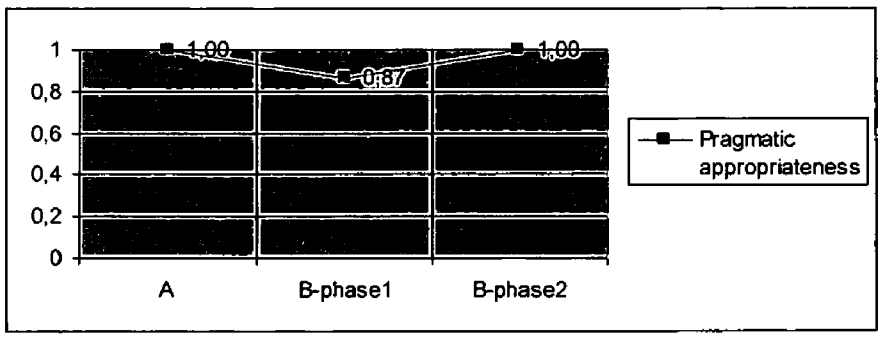


Figure K4.5. Participation pre-intervention (A) and after the introduction of intervention (B)

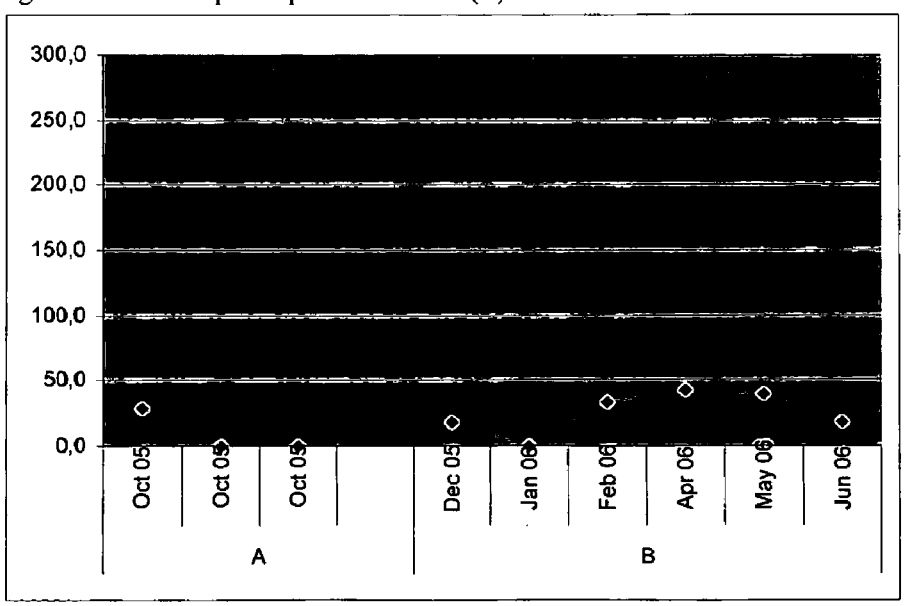


Table G1.1. Profile: Child G1

Gender	Male
Age at the start of intervention	7 years 2 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	7 months
Assessment duration	8 months
Teacher's use of microphone	Teacher wore the microphone 3 out of 6 days the researcher arrived

Figure G3.1. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

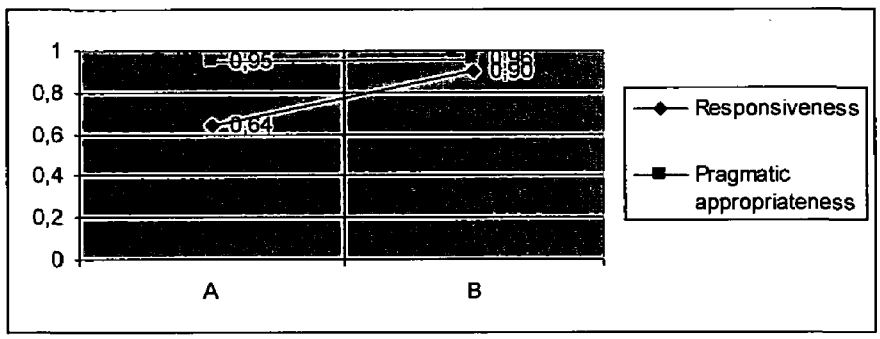


Figure G4.1. Participation pre-intervention (A) and after the introduction of intervention (B)

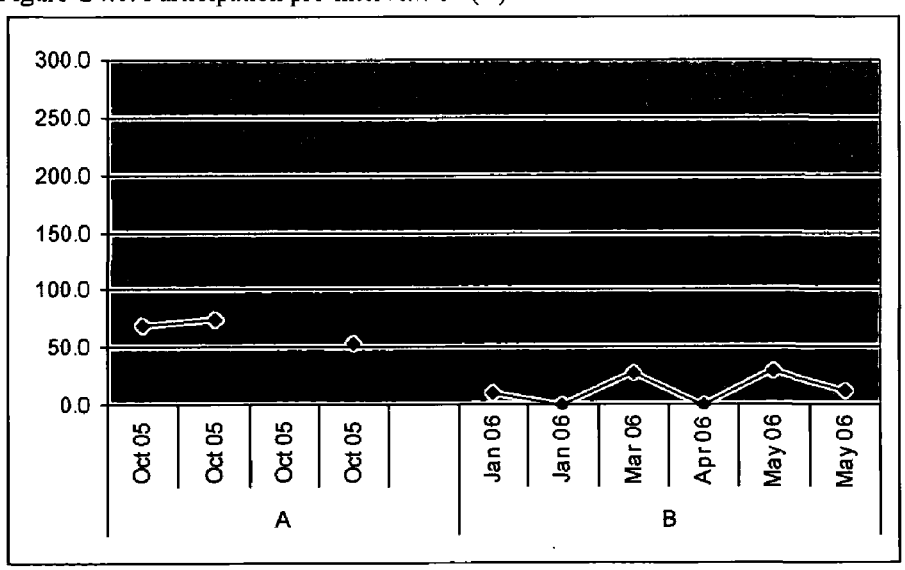


Table G1.2. Profile: Child G2

Gender	Male
Age at the start of intervention	7 years 8 months
Language skills pre-intervention	Moderate receptive 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	8 months
Teacher's use of microphone	Teacher wore the microphone 3 out of 6 days the researcher arrived

Figure G3.2. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

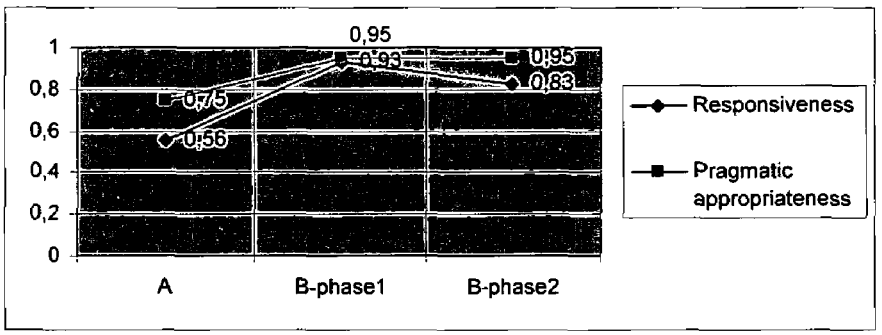


Figure G4.2. Participation pre-intervention (A) and after the introduction of intervention (B)

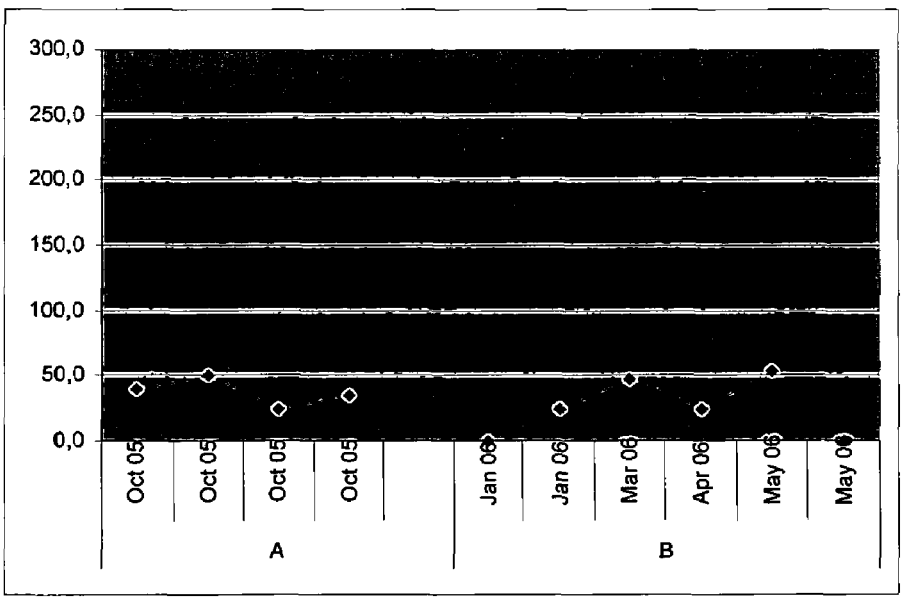


Table G1.3. Profile: Child G3

Gender	Male
Age at the start of intervention	7 years
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	7 months
Assessment duration	8 months
Teacher's use of microphone	Teacher wore the microphone 3 out of 6 days the researcher arrived

Figure G3.3. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

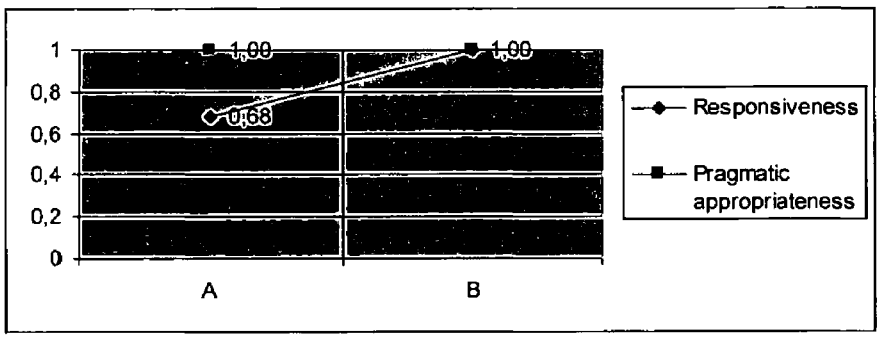


Figure G4.3. Participation pre-intervention (A) and after the introduction of intervention (B)

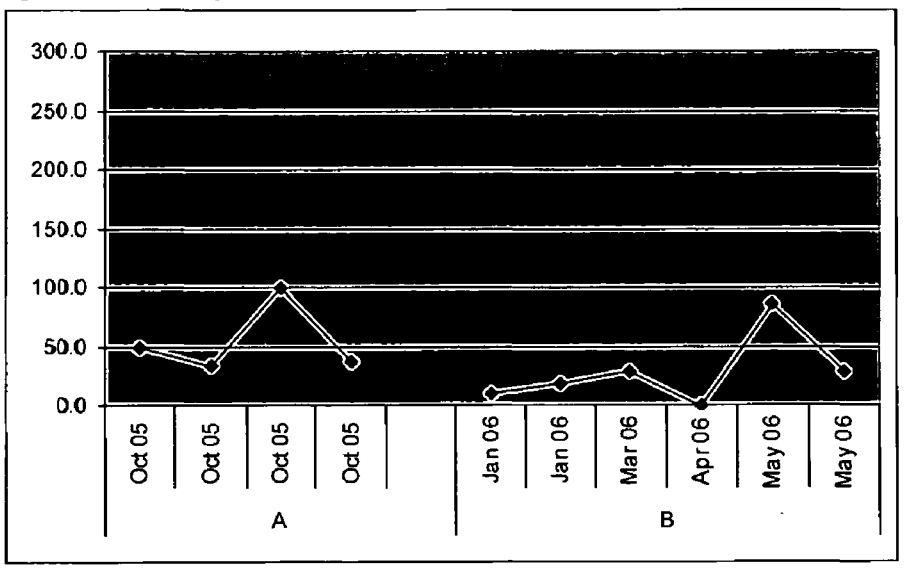


Table G1.4. Profile: Child G4

Gender	Male
Status	'Ear, nose, throat problems' – underwent grommet microsurgery during the study. Minor ear infections could occur after grommet microsurgery.
Age at the start of intervention	7 years and 8 months
Language skills pre-intervention	Within norms for age receptive language
Auxiliary services during the study	No
Family situation during the study	Family intervening factors from December 06 onwards
Exposure to intervention	7 months
Assessment duration	8 months
Teacher's use of microphone	Teacher wore the microphone 3 out of 6 days the researcher arrived

Figure G3.4. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

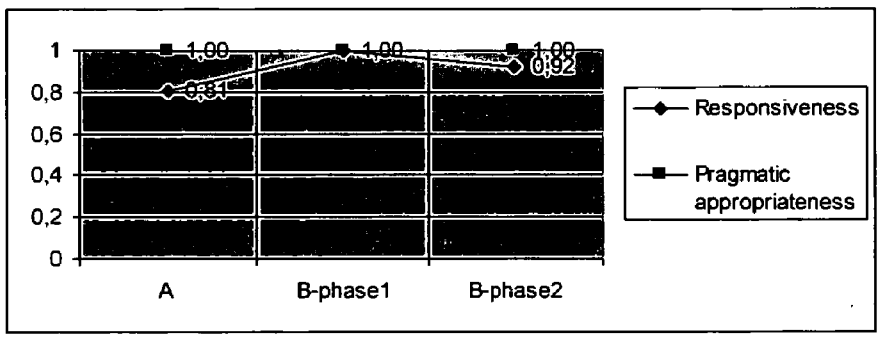


Figure G4.4. Participation pre-intervention (A) and after the introduction of intervention (B)

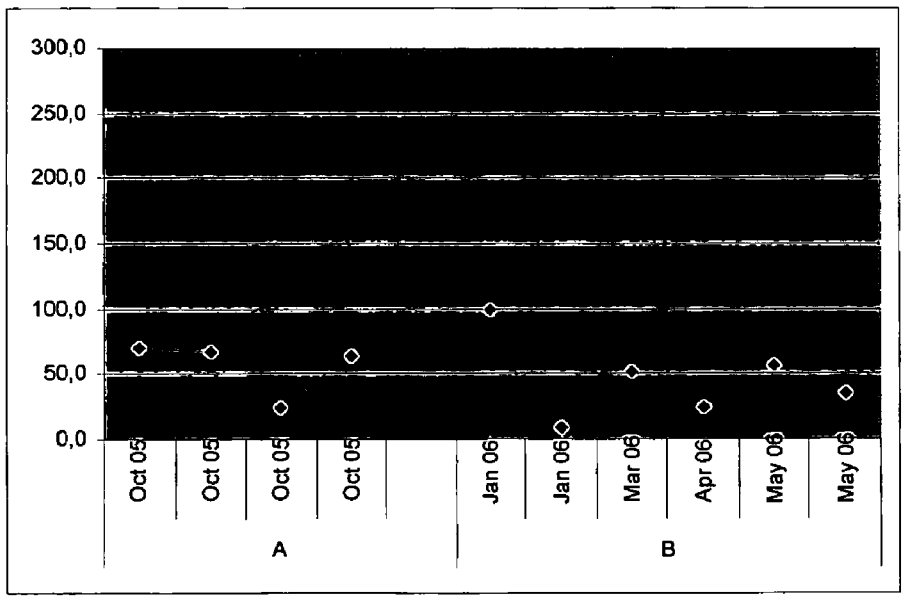


Table F1.1. Profile: Child F1

Gender	Female
Status	Attention difficulties
Age at the start of intervention	5 years 6 months
Language skills pre-intervention	Within norms for age expressive language Within norms for age receptive vocabulary
Auxiliary services during the study	Some health problems around mid February06
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure F3.1. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

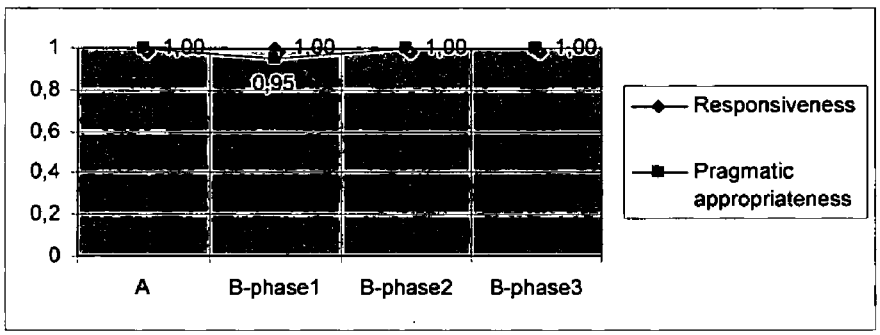


Figure F4.1. Participation pre-intervention (A) and after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)

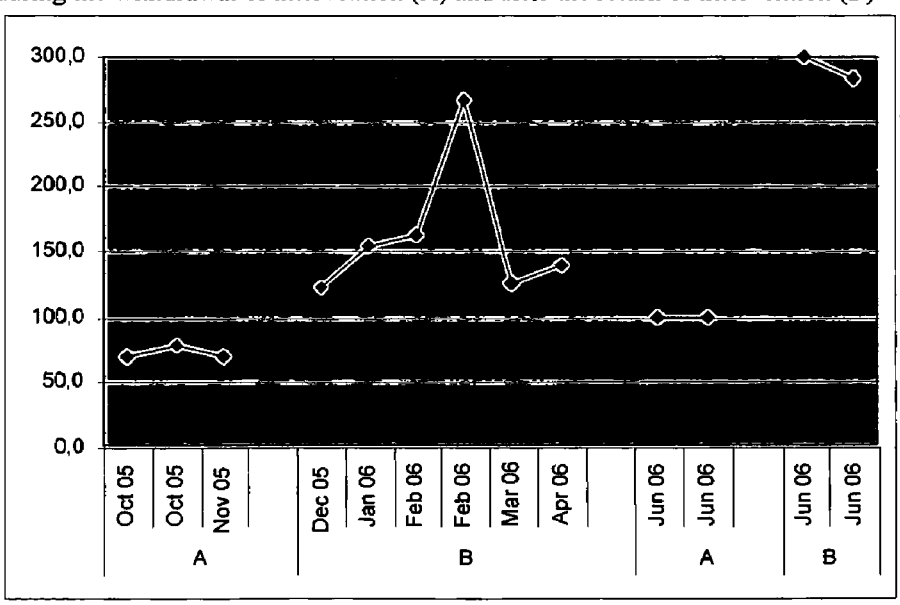


Table F1.2. Profile: Child F2

Gender	Male
Status	Attention difficulties
Age at the start of intervention	6 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 situations during the study	Teacher was not aware of any major changes
Exposure to intervention	9 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure F3.2. Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

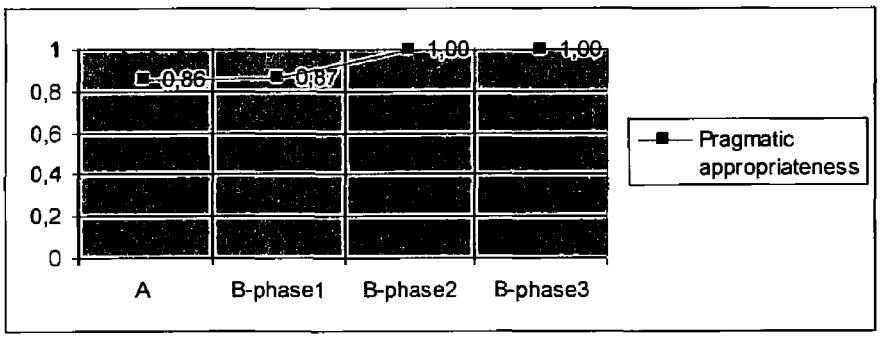


Figure F4.2. Participation pre-intervention (A) and after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)

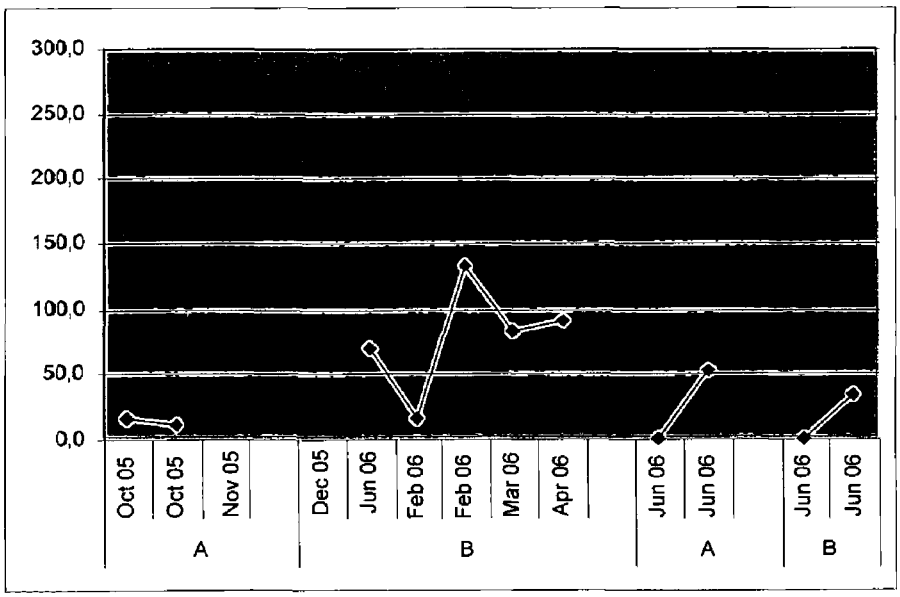


Table F1.3. Profile: Child F3

Gender	Male
Status	Attention difficulties
Age at the start of intervention	7 years 6 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	9 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure F3.3. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

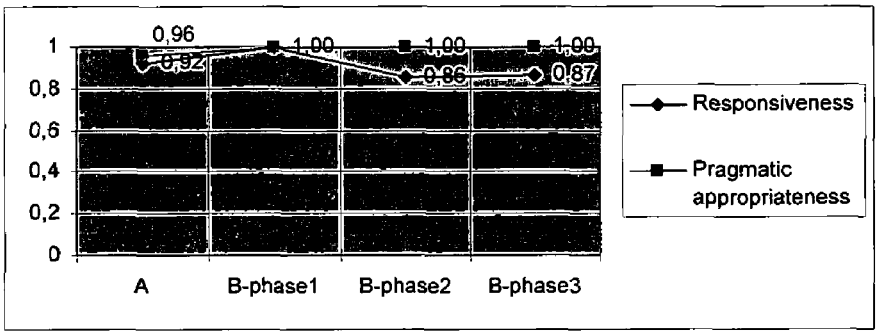


Figure F4.3. Participation pre-intervention (A) and after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)

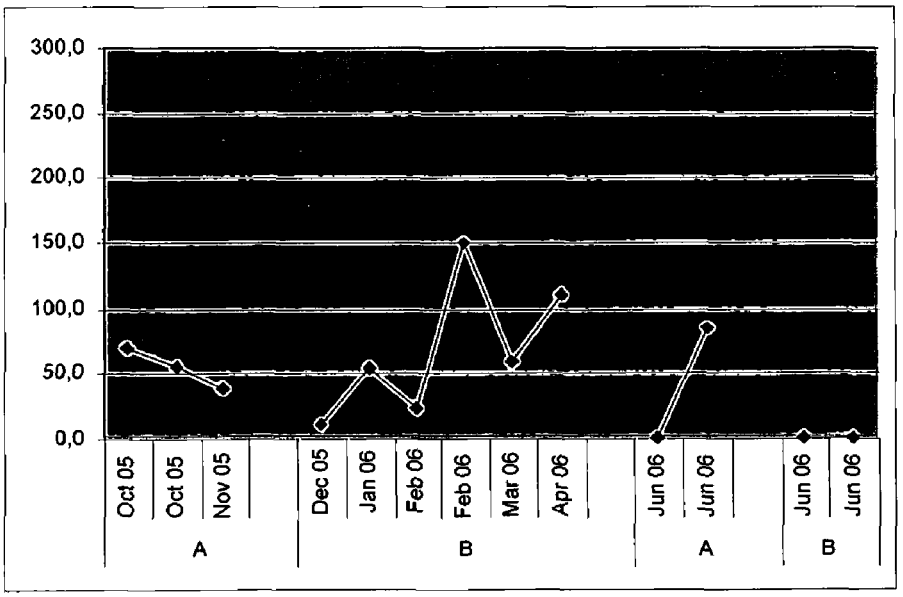


Table F1.4. Profile: Child F4

Gender	Male
Status	Attention difficulties
Age at the start of intervention	6 years 8 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	9 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone every time the researcher arrived

Figure F3.4. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

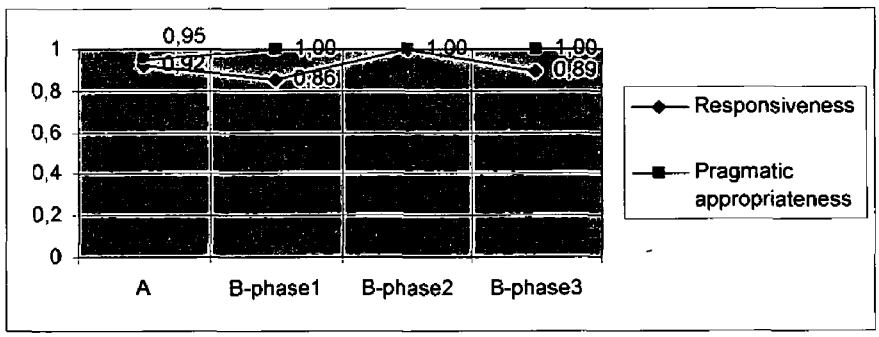


Figure F4.4. Participation pre-intervention (A) and after the introduction of intervention (B), during the withdrawal of intervention (A) and after the return of intervention (B)

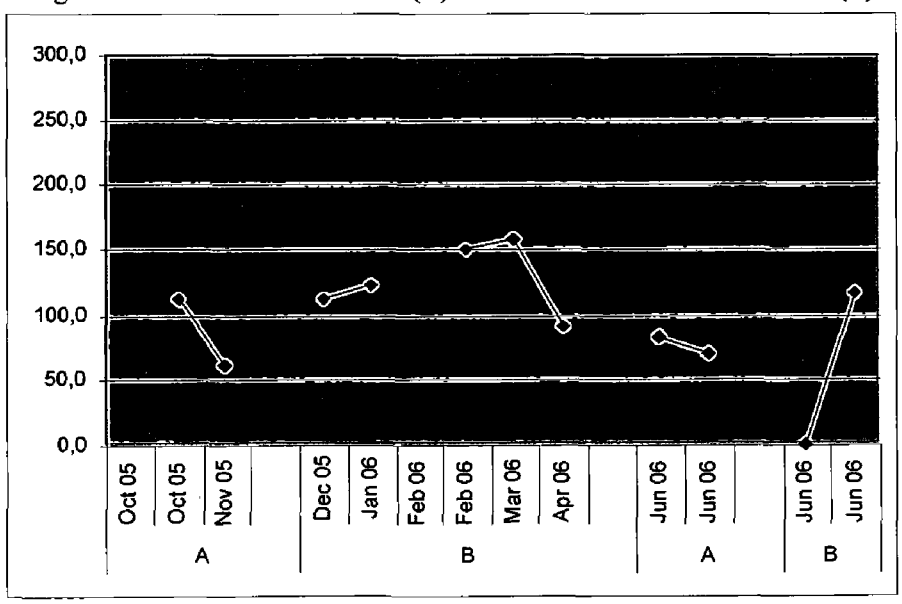


Table O1.1. Profile: Child O1

Gender	Male
Age at the start of intervention	6 years 6 months
Language skills pre-intervention	Severe receptive language disorder
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	8 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 7 the researcher arrived

Figure O3.1. Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

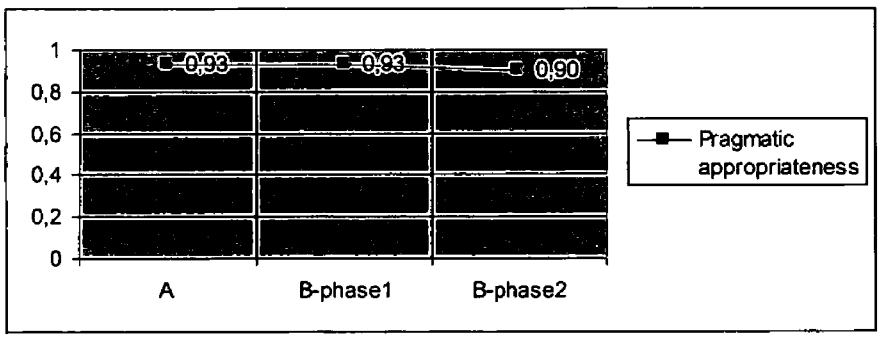


Figure O4.1. Participation pre-intervention (A) and after the introduction of intervention (B)

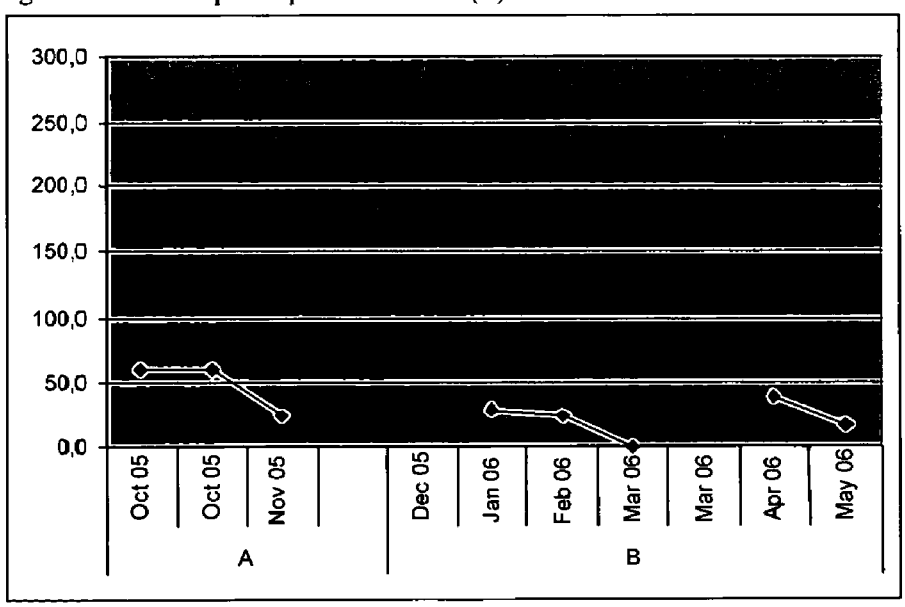


Table O1.2. Profile: Child O2

Gender	Female
Status	Attention difficulties
Age at the start of intervention	6 years
Language skills pre-intervention	Moderate receptive 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	9 months
Assessment duration	12 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 7 the researcher arrived

Figure O3.2. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

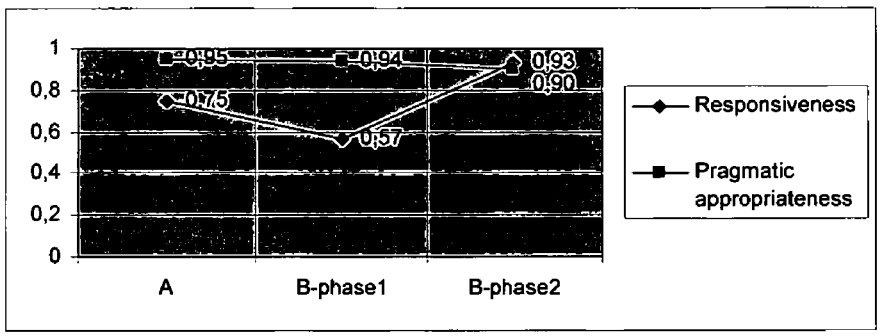


Figure O4.2. Participation pre-intervention (A) and after the introduction of intervention (B)

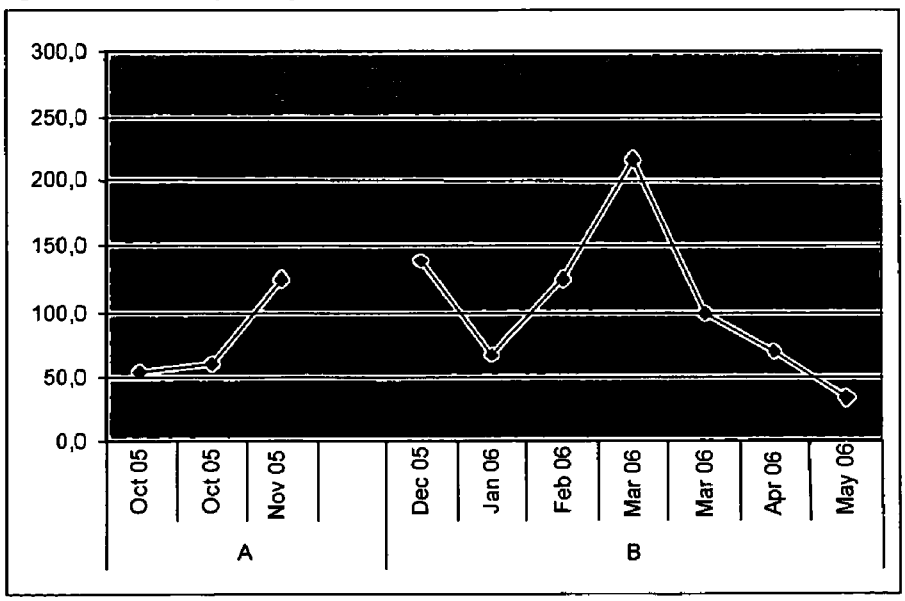


Table O1.3. Profile: Child O3

Gender	Female
Age at the start of intervention	6 years 4 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*	12 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 7 the researcher arrived

Figure O3.3. Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

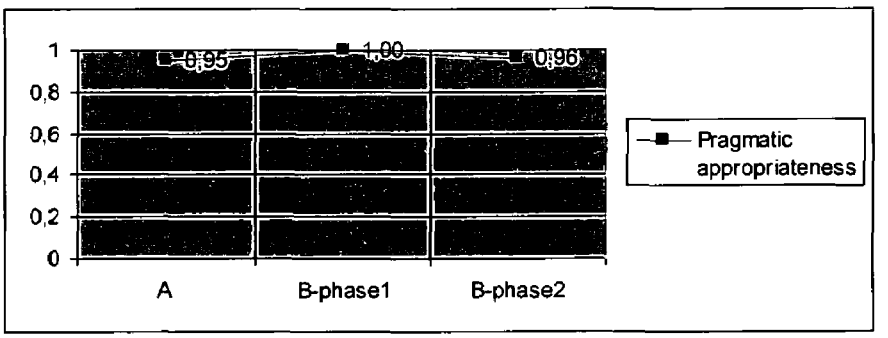


Figure O4.3. Participation pre-intervention (A) and after the introduction of intervention (B)

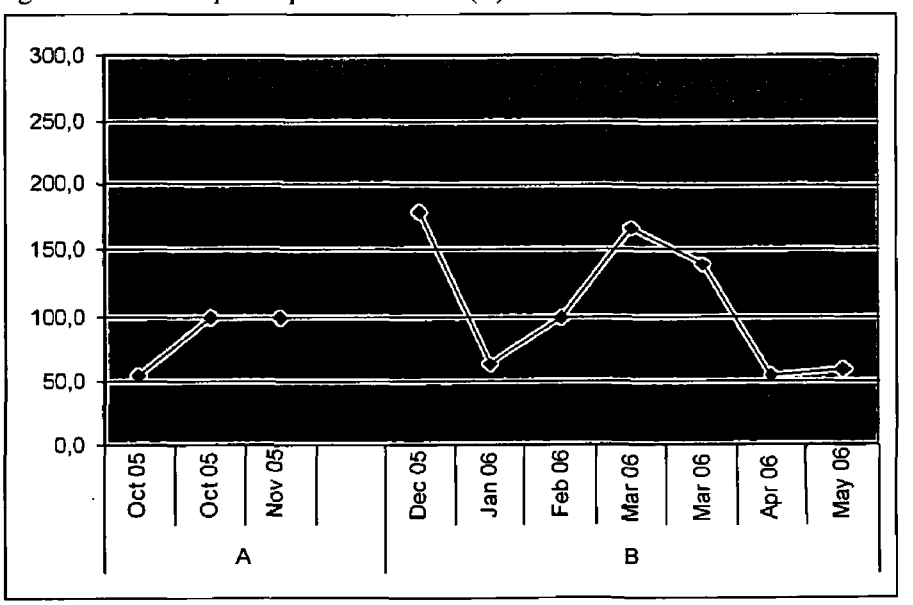


Table O1.4. Profile: Child O4

Gender	Male
Status	Attention difficulties
Age at the start of intervention	5 years and 10 months
Language skills pre-intervention	Mild 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	12 months
Teacher's use of microphone	Teacher wore the microphone on 4 days out of 7 the researcher arrived

Figure O3.4. Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

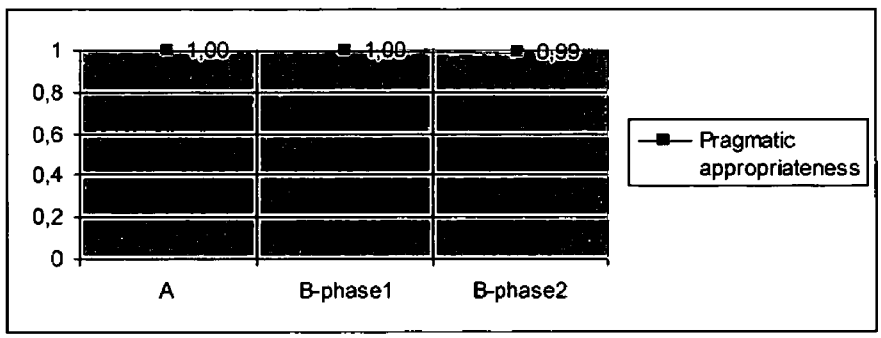
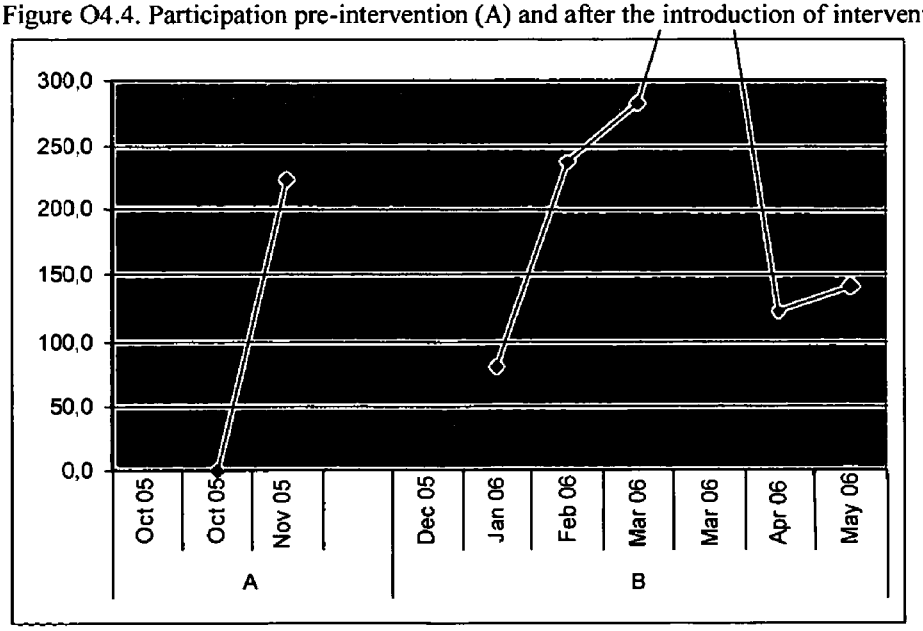


Figure O4.4. Participation pre-intervention (A) and after the introduction of intervention (B)[165]



[165] Participation during the 5th observed lesson in the intervention phase was higher than 400.00.

Table M1.1. Profile: Child M1

Gender	Male
Age at the start of intervention	5 years 9 months
Language skills pre-intervention	Moderate receptive language disorder Mild expressive language disorder
Auxiliary services during the study	Weekly resource hours in school Reading Recovery programme
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone on 0 days out of 8 the researcher arrived. The microphone was not charged two times before the scheduled recording.

Figure M3.1. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

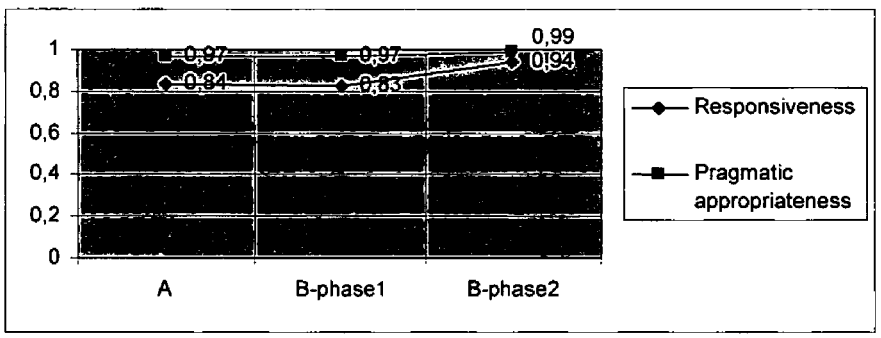


Figure M4.1. Participation pre-intervention (A) and after the introduction of intervention (B)

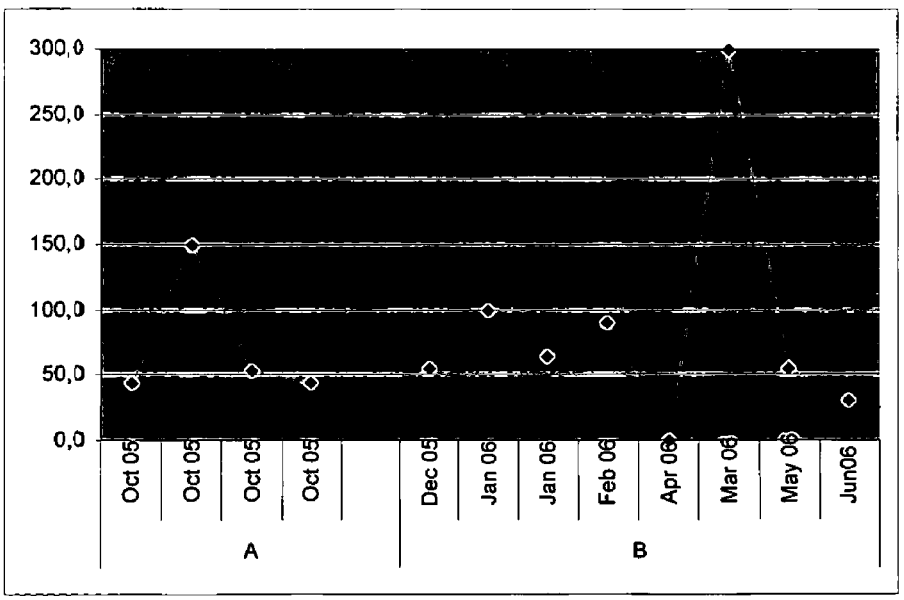


Table M1.2. Profile: Child M2

Gender	Male
Status	Attention difficulties
Age at the start of intervention	6 years 5 months
Language skills pre-intervention	Severe receptive language disorder Severe expressive language disorder
Auxiliary services during the study	Weekly resource hours in school Reading Recovery programme
Family situation during the study	Changes in the family situation after Easter which the child reported as being positive
Exposure to intervention	8 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone on 0 days out of 8 the researcher arrived. The microphone was not charged two times before the scheduled recording.

Figure M3.2. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

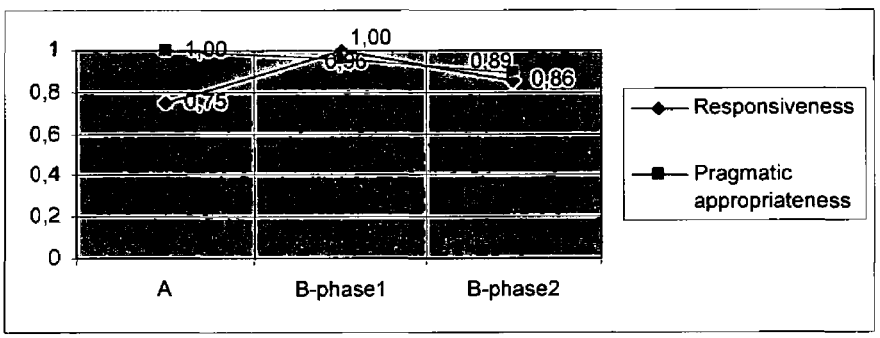


Figure M4.2. Participation pre-intervention (A) and after the introduction of intervention (B)

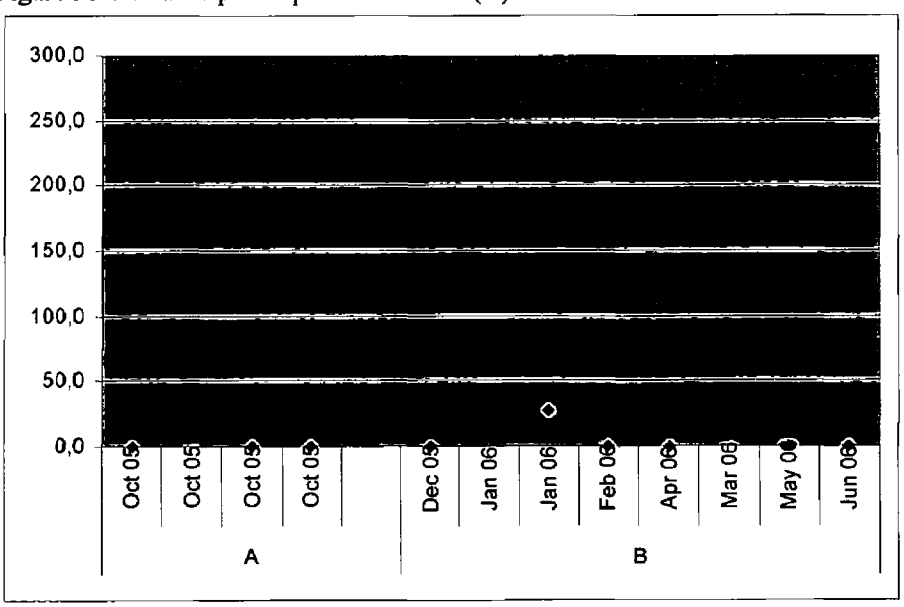


Table M1.3. Profile: Child M3

Gender	Male
Age at the start of intervention	6 years 3 months
Language skills pre-intervention	Within norms for age receptive language Moderate expressive language disorder
Auxiliary services during the study	Weekly resource hours in school Reading Recovery programme
Family situation during the study	Some family intervening problems around December
Exposure to intervention	8 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone on 0 days out of 8 the researcher arrived. The microphone was not charged two times before the scheduled recording.

Figure M3.3. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

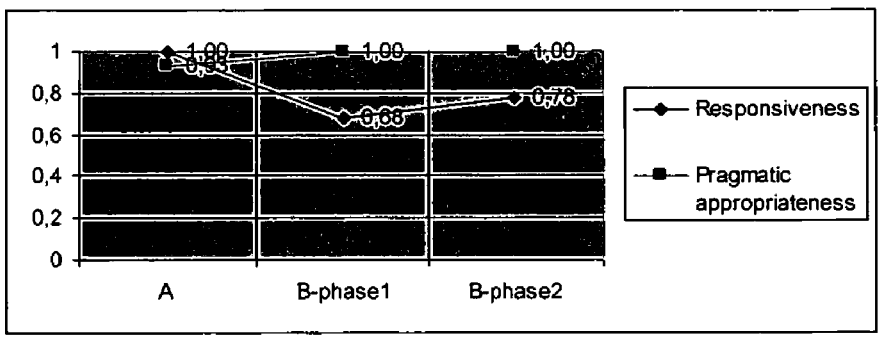


Figure M4.3. Participation pre-intervention (A) and after the introduction of intervention (B)

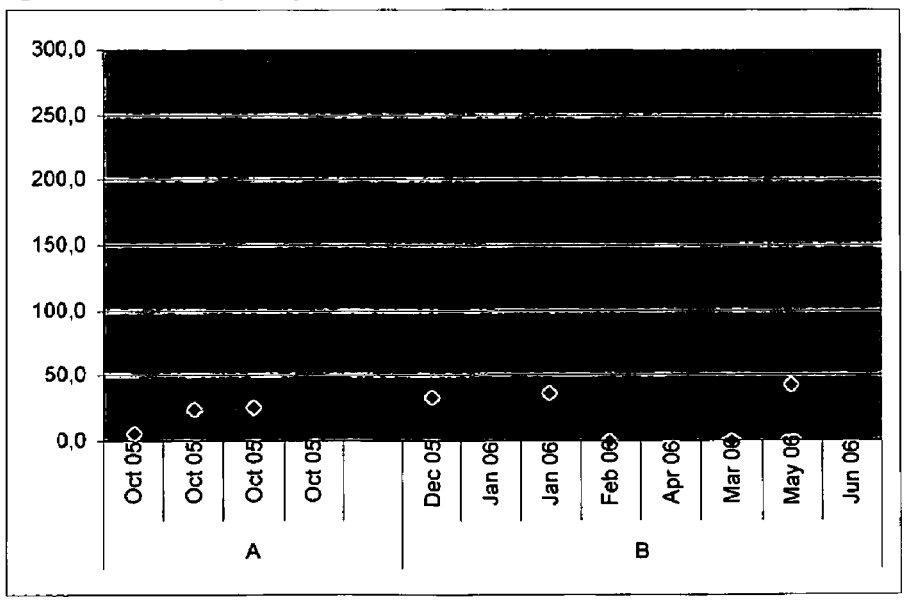


Table M1.4. Profile: Child M4

Gender	Male
Status	He had hearing problems and he underwent grommet microsurgery during the course of intervention. Minor ear infections could occur after grommet microsurgery.
Age at the start of intervention	6 years 3 months
Language skills pre-intervention	Moderate receptive language disorder Moderate expressive language disorder
Auxiliary services during the study	Reading Recovery programme
Family situation during the study	Teacher was not aware of any major changes
Exposure to intervention	8 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone on 0 days out of 8 the researcher arrived. The microphone was not charged two times before the scheduled recording.

Figure M3.4. Responsiveness and Pragmatic appropriateness pre-intervention (A) and after the introduction of intervention (B)

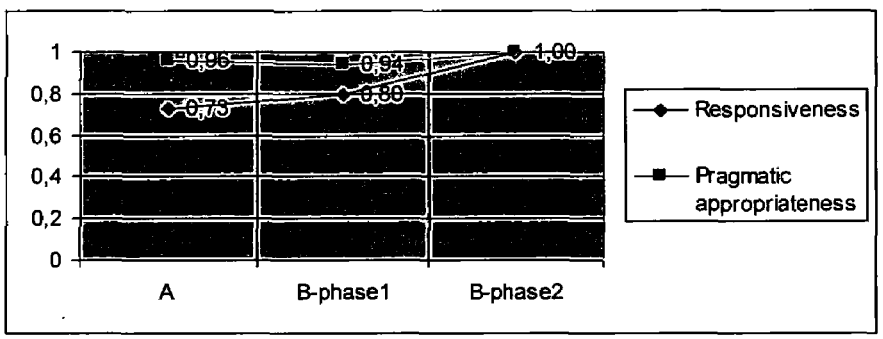


Figure M4.4. Participation pre-intervention (A) and after the introduction of intervention (B)

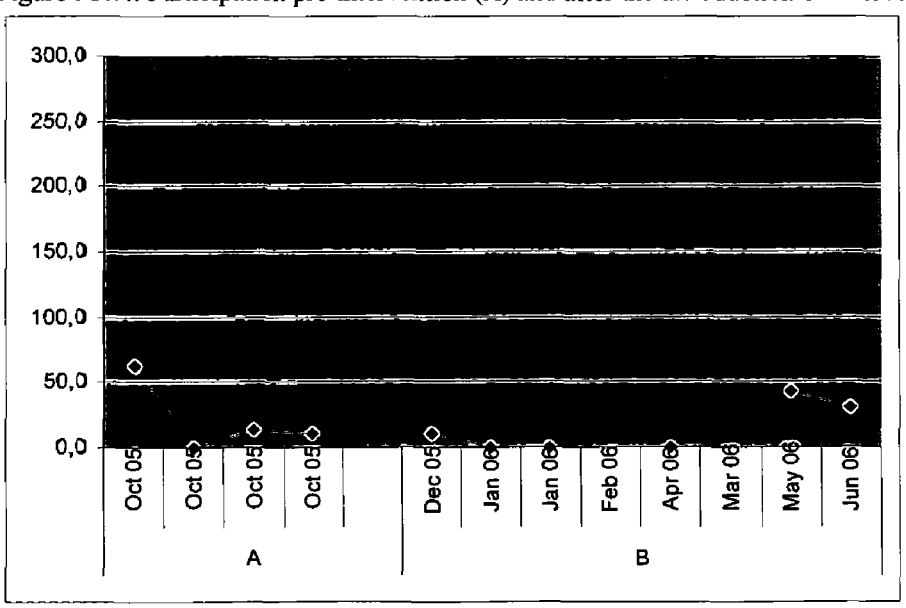


Table N1.1. Profile: Child N1

Gender	Female
Age at the start of intervention	5 years 7 months
Language skills pre-intervention	Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Some family related intervening problems around May/June
Exposure to intervention	7 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone 2 days out of 5 the researcher arrived

Figure N3.1. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[166]

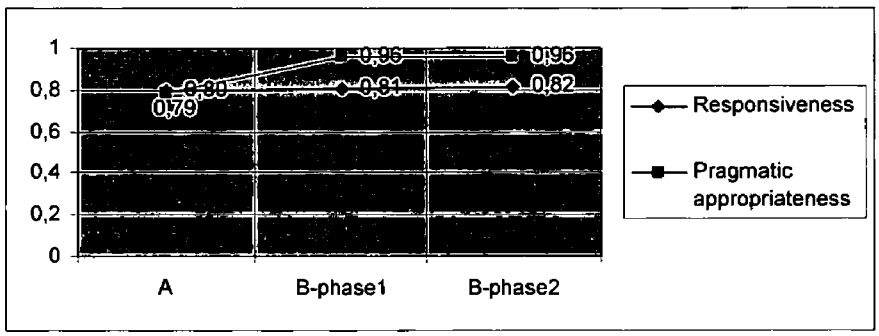
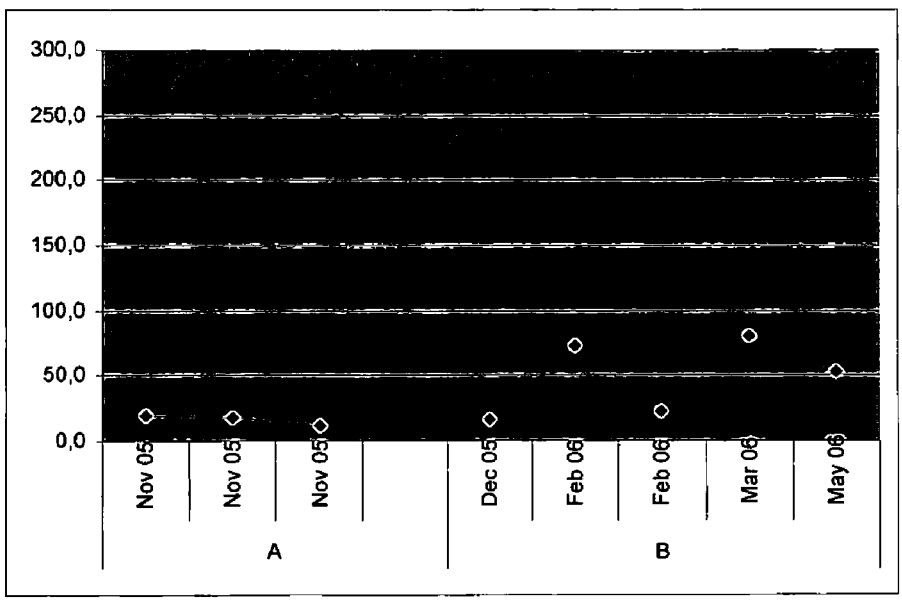


Figure N4.1. Participation pre-intervention (A) and after the introduction of intervention (B)



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

Table N1.2. Profile: Child N2

Gender	Female
Age at the start of intervention	4 years 9 months
Language skills pre-intervention	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	7 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone 2 days out of 5 the researcher arrived

Figure N3.2. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[167]

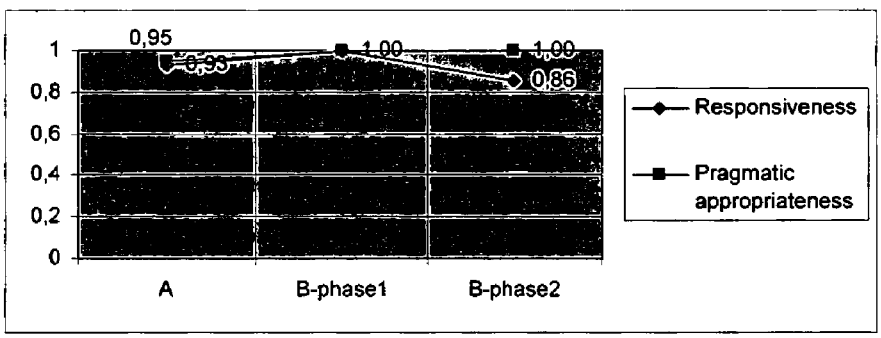
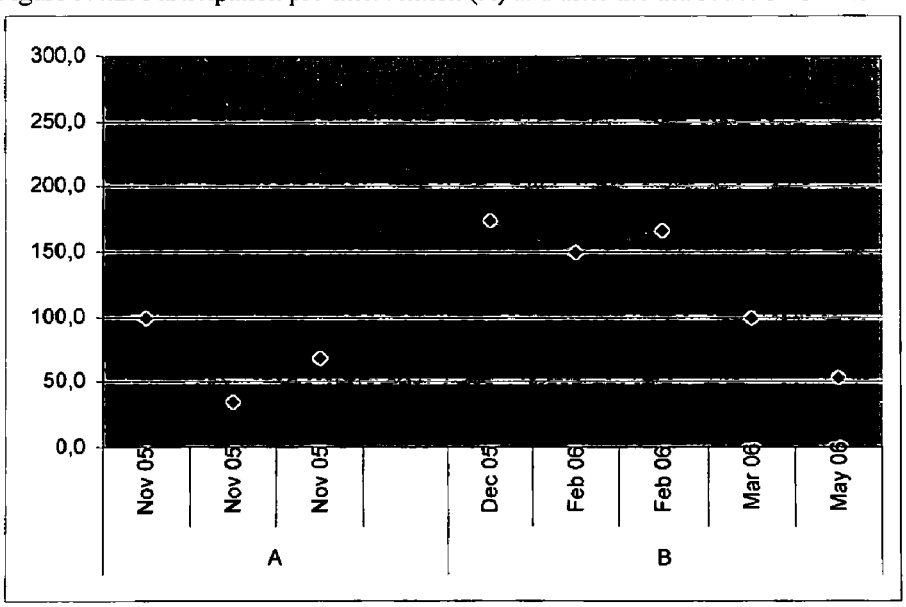


Figure N4.2. Participation pre-intervention (A) and after the introduction of intervention (B)



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

Table N1.3. Profile: Child N3

Gender	Female
Status	Attention difficulties
Age at the start of intervention	5 years 2 months
Language skills pre-intervention	Within norms for age receptive vocabulary
Auxiliary services during the study	No
Family situation during the study	Some family intervening factors around and after Christmas which according to the teacher's reports affected her functioning at school
Exposure to intervention	7 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone 2 days out of 5 the researcher arrived

Figure N3.3. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[168]

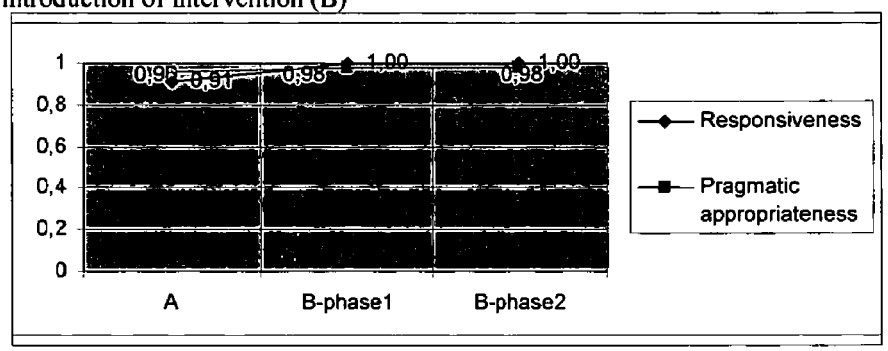
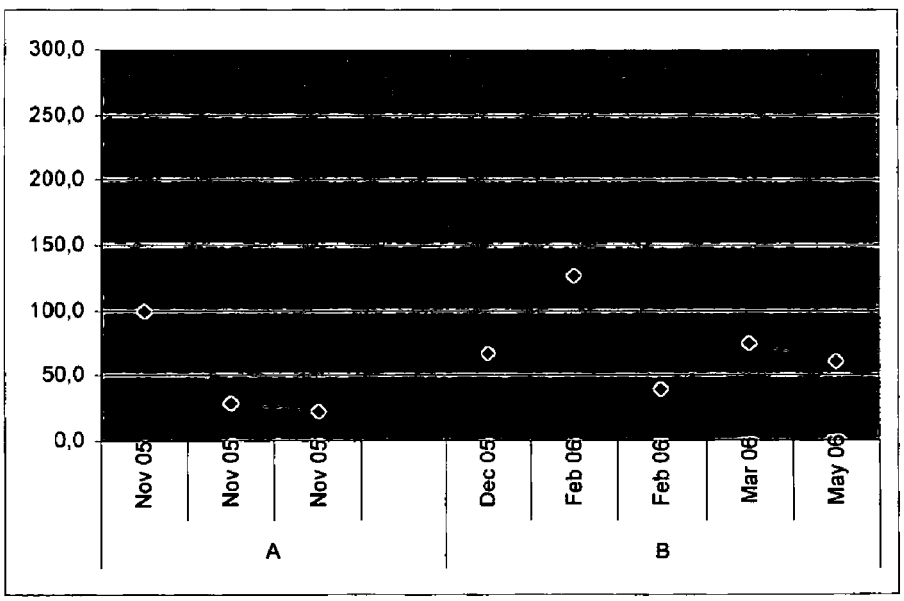


Figure N4.3. Participation pre-intervention (A) and after the introduction of intervention (B)



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

Table N1.4. Profile: Child N4

Gender	Female
Status	Attention difficulties
Age at the start of intervention	5 years 3 months
Language skills pre-intervention	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	7 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone 2 days out of 5 the researcher arrived

Figure N3.4. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[169]

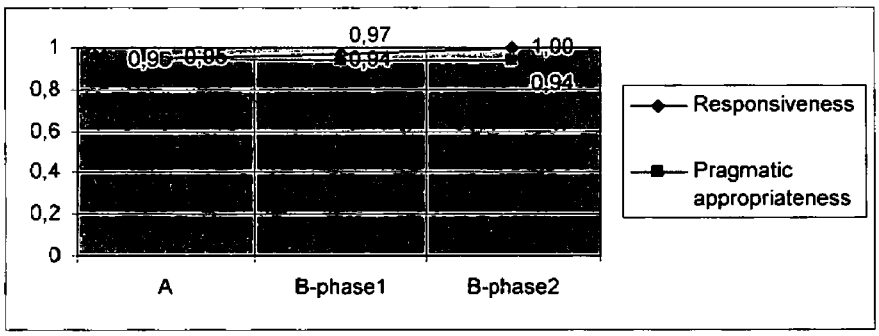
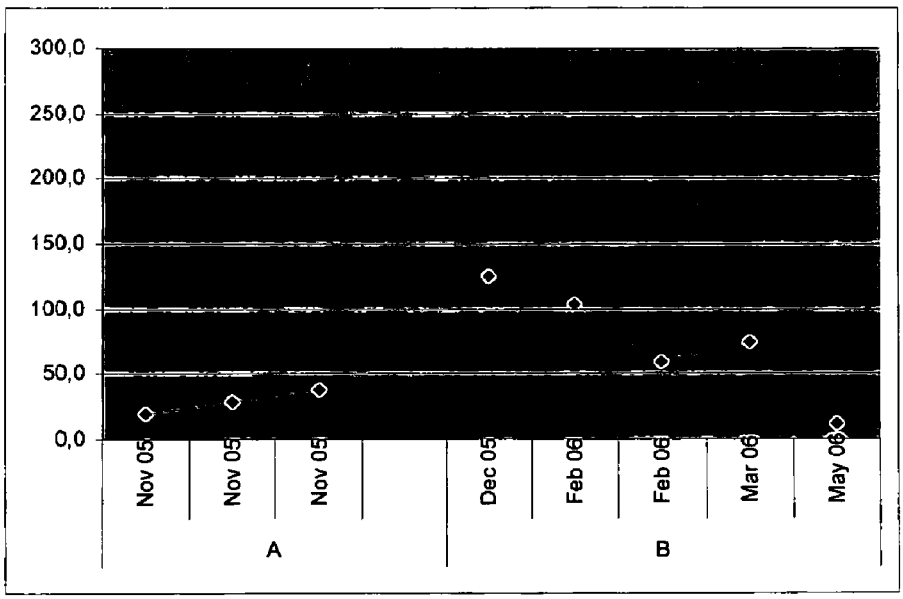


Figure N4.4. Participation pre-intervention (A) and after the introduction of intervention (B)



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

Table N1.5. Profile: Child N5

Gender	Female
Status	Inconclusive result of a hearing test conducted by a public health nurse visiting the school Attention difficulties
Age at the start of intervention	5 years 9 months
Language skills pre-intervention	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	7 months
Assessment duration	14 months
Teacher's use of microphone	Teacher wore the microphone 2 days out of 5 the researcher arrived

Figure N3.5. **Responsiveness** and **Pragmatic appropriateness** pre-intervention (A) and after the introduction of intervention (B)[170]

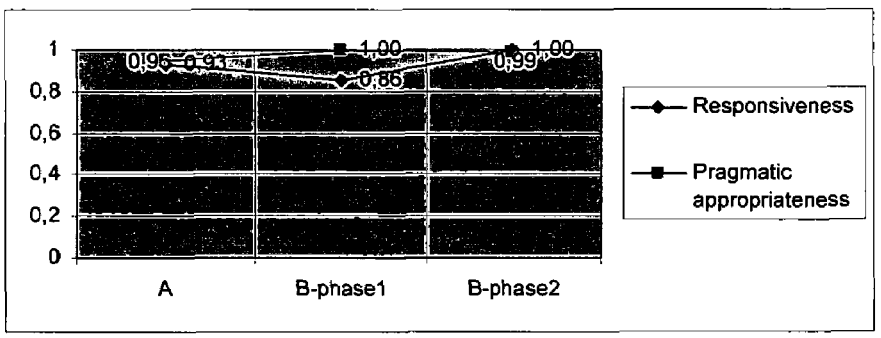
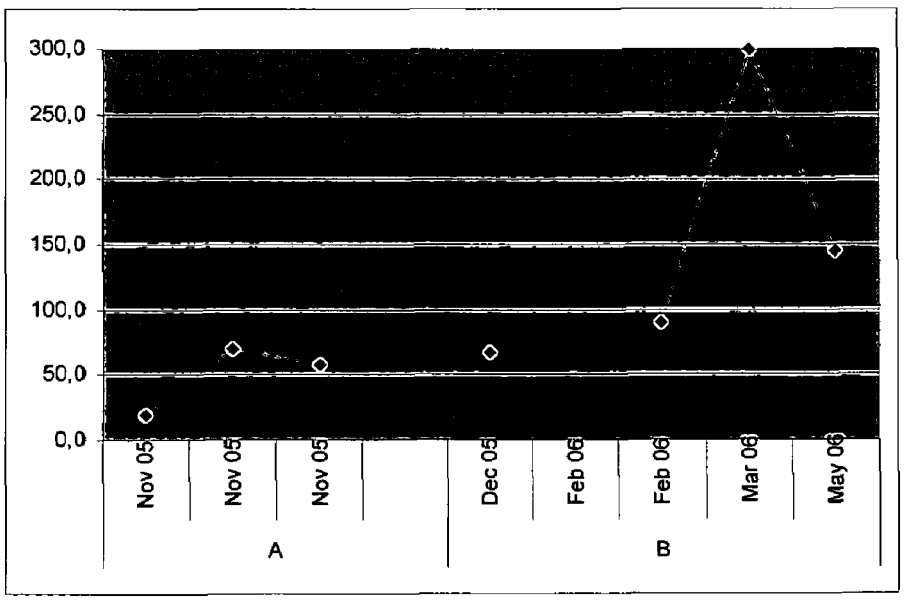


Figure N4.5. Participation pre-intervention (A) and after the introduction of intervention (B)



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