

# The Impact of a Digital Speaker on a Teacher's Interaction with a Child with Limited Functional Speech

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## ABSTRACT

*This paper describes the impact of the implementation of a digital speaker and teacher training on the quality of a teacher's interaction with an AAC user. The data was obtained by recording and analysing classroom story time interactions. The types of utterances directed at each child in the class, the types of questions used as well as the messages recorded onto the digital speaker were determined for each research phase. There were four major phases in the research, namely, a pre-implementation phase, a post-implementation phase, a post-training phase and a post-withdrawal phase. The results indicated that the implementation of the digital speaker and the training of the teacher resulted in certain changes in the way that the teacher interacted with the AAC user. Utterance types such as answering and imitating were used more frequently after the implementation of the device. There was also a much greater variety in the teacher's use of questions as well as in the messages that were recorded onto the digital speaker after the five training sessions were completed. This study highlighted the importance of formal training for the communication partners of the AAC user. One of the most important communication partners of the school-aged AAC user is the classroom teacher.*

## OPSOMMING

*Hierdie studie beoog om die impak van die implementering van 'n digitale spreker en die opleiding van die onderwyser op die kwaliteit van die onderwyser se interaksie met die AAK-gebruiker te bepaal. Die data is verkry deur die opneem en analisering van klaskamer-storietyd-interaksies. Die tipes interaksies wat aan elke kind in die klas gerig is, sowel as die tipes vrae wat gebruik is asook die boodskappe wat opgeneem is op die digitale spreker gedurende elke navorsingsfase is bepaal. Daar was vier fases in die navorsing, naamlik, 'n voor-implementeringsfase, 'n na-implementeringsfase, 'n na-opleidingsfase asook 'n na-onttrekkingsfase. Die resultate het daarop gedui dat die implementering van die digitale spreker en die opleiding van die onderwyser gelei het tot sekere veranderinge in die onderwyser se interaksies met die AAK-gebruiker. Interaksie-tipes soos antwoorde en nabootsing het meer dikwels voorgekom na die implementering van die digitale spreker. Daar was ook 'n groter verskeidenheid boodskappe op die digitale spreker na die vyf opleidingsessies voltooi is. Hierdie navorsing beklemtoon die belang van formele opleiding vir al die mense wat met die AAK-gebruiker kommunikeer. Een van die mees belangrike mense wat met die skoolgaande AAK-gebruiker in interaksie tree, is die onderwyser.*

**KEYWORDS:** classroom interaction, device implementation, teacher training, use of questions

Literature has indicated that teachers adjust to children with limited speech by changing their interaction patterns (Light, 1988; Cicognani & Zani, 1992). Teachers take more turns and initiate conversations more often. They use more direct questions, attention directing utterances and requests, and less answers, imitations, praise and higher-level questions with the children who have limited or no functional speech (Light, 1988; Cicognani & Zani, 1992). Owing to the exclusion from interaction and the teacher's use of certain types of interactions and questions, the child who has limited or no functional speech (LNFS) can adopt an exaggerated passivity and develop an attitude of learned helplessness (Basil, 1992).

A previous study was done (Popich & Alant, 1997) which examined the verbal interactions which occurred between a teacher and two groups of children (children with LNFS as well as children who were speaking). Descriptive data, generated by analysing ten lessons, suggested that the

teacher's interaction with the children with limited or no functional speech (LNFS) differed, in terms of quantity and quality. The teacher directed approximately 10% less interaction at each of these (children with LNFS) three children, when compared with the number of interactions that the teacher directed at each of the five speaking children. However, as can be expected, she also did not spend an equal amount of time interacting with each of the children with LNFS. Her interaction with these children was dominated by questions, attention directing and requesting. Interaction types, such as answering and imitating did not occur at all in the teacher's interaction with the children with LNFS. The children with LNFS therefore had different learning experiences in the classroom to the speaking children. These results formed the basis for the current research study as the researchers wanted to determine whether these patterns in the teacher's interaction with the individuals with limited or no functional speech would

be influenced by the implementation of a voice output device.

There is little doubt as to the positive effects of the implementation of AAC systems on children with LNFS. Children who use AAC in the classroom have demonstrated better communication competence, initiate more frequently, use more complex sentences and demonstrate more control in interactions (Smith, 1994). There are also a greater number of AAC users who now participate in education and recreation and the number of AAC users being employed is also increasing (Beukelman, 1991).

AAC gives the user access to communication and interaction and increases participation and learning. A greater ability to interact results in improved social abilities, an increase in social acceptance by the community and an improvement in the quality of life. Increases in participation and learning result in progress at school and a higher level of education for the individual who has limited or no functional speech.

However, in a classroom situation, where the goal is not only to interact or to learn language, but also to use language to acquire knowledge and skills, one is no longer only concerned with how the implementation of an AAC system such as a voice output device (VOCA) will affect the child's interaction, but also with how the device will affect the child's primary interaction partner in the school setting, namely the teacher. If a VOCA is implemented in a classroom the teacher takes on many new roles and responsibilities. The teacher will need to adapt the curriculum and write objectives for the AAC user. Materials such as device overlays will have to be made and the teacher will have to record messages onto the device. Furthermore the teacher will be responsible for assessing progress, providing ongoing skill development, identifying vocabulary and communication needs as well as many other administrative tasks (Locke & Mirinda, 1992). These additional roles and responsibilities may affect the teacher's attitude towards AAC implementation as well as the AAC user.

The teacher is a significant interaction partner and will greatly influence the success or failure of the AAC device as a communication tool in the classroom (Dalton & Bedrosian, 1989). The teacher may, however, not be fully equipped for many of the new responsibilities resulting from AAC device implementation and training is critical in order to ensure success (Locke & Mirinda, 1992; Baker, 1993). The majority of teachers working with children who use AAC devices desire further inservice training and workshops (Locke & Mirinda, 1992). Teachers primarily feel the need to increase their knowledge on AAC techniques and AAC devices but also to improve their skill in management issues such as identifying appropriate vocabulary. Research (Soto, 1997) has found a direct correlation between teachers' perceptions of their own levels of skill with their attitudes towards AAC implementation. Furthermore teachers' perceptions of their own skills had a direct influence on their impression of the AAC users' abilities to improve their communication effectiveness.

The effects of training on the teachers' ability to adapt to the presence of an AAC user in the class, will depend greatly on the content of the inservice training. If the training concentrated on the development of skills, such as the understanding of technical aspects of the AAC device or on the necessary preparations (for example making an overlay) for the use of the AAC device then one would expect changes to occur in these areas. On the other hand if train-

ing emphasised the development of strategies, such as the teacher's style of interaction and use of questions, then changes in this area would be expected. For the benefit of the AAC user, however, it is necessary to pay attention to the development of the teacher's operational skills and the development of strategies in order to ensure the most effective implementation of AAC (Blackstone, 1986). It would be important to determine whether the provision of training, to the teacher, would result in an increased utilisation of the AAC device in the classroom as well as whether it would result in changes in the teacher's interactions with the AAC user.

Previous studies have found training in the use of questions to result in significant positive changes in the teacher's questioning techniques (Greenberg & Woodside, 1994). Questioning is one of the most important and most frequently used teaching techniques. Teachers use questions to stimulate thought, to assess progress, to motivate children to pay attention, to maintain control, to provide repetition and emphasise key issues (Camp, 1993). The types of questions teachers use have a significant influence on the amount of initiations made by the children, the types of responses given, the amount of learning and the level of thought obtained (Cicognani & Zani, 1992; Fowell & Lawton, 1992; Greenberg & Woodside, 1994). Insufficient research has, however, been done on the effects of training on teachers' use of questions with AAC users, changes in general interaction styles and the effect of training on the utilisation of AAC devices in classrooms.

## METHOD

### AIM

This study aims to describe the impact of AAC device implementation and teacher training, in a classroom situation, on the teacher's interactions with the AAC user. The types of utterances that were directed at the speaking children were compared to the utterances that were directed at the children with LNFS and the AAC user. Furthermore the use of questions and the selection of messages on the AAC device, by the teacher, during each of the four research phases were determined. The results of each of the research phases were compared in order to ascertain the effect of the implementation of the VOCA, the teacher training sessions as well as the period of withdrawal.

### RESEARCH DESIGN

Although there were nine children in the class of whom three had limited or no functional speech, only one AAC device was implemented. The focus of the study was on the teacher's interaction with the individual who was using the AAC device. A single case quasi-experimental design with multiple measurements (ABA with withdrawal) was used as it is ideally suited to studying the effect of individual variables on communicative behaviour (in this case classroom interaction) and provides empirical data for clinical interventions.

There were four major phases in the research, namely A1, B1, B2 and A2. During each research phase six measurements were made of the teacher interacting with the whole class and six measurements were made of the teacher interacting with the AAC candidate on an individual basis, during a period of two weeks. It was necessary to use six

measurements to ensure that consistent baseline data was obtained. Group as well as individual sessions were used in order to determine whether the teacher's interactional style was influenced by the situation.

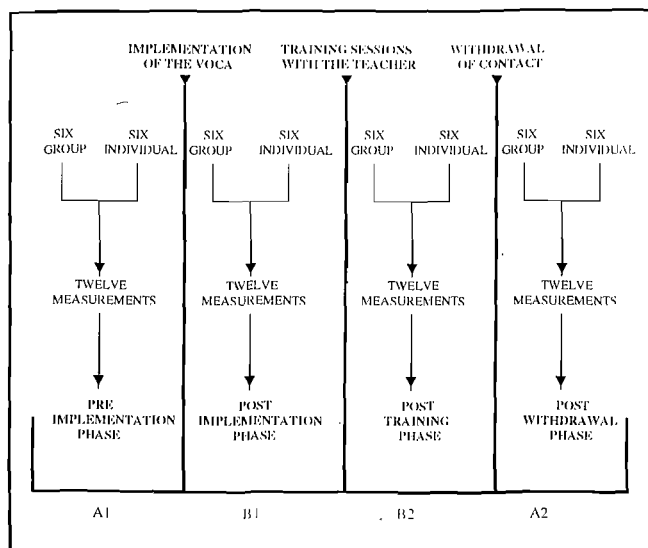


FIGURE 1: The research phases

During the measurements of the first phase the child was not using the digital speaker in the class (pre-implementation phase, A1). After this phase was completed the digital speaker was implemented in the classroom. Prior to this the AAC user had only used the digital speaker during speech therapy sessions. Although the AAC user was trained to operate the device the teacher had not received any training yet (post-implementation phase or, alternatively, pre-training phase, B1). After this phase five training sessions, of approximately one hour each, were held on five consecutive days. After the training was completed more measurements were made (post-training phase, B2). A withdrawal phase of eight weeks followed (post-withdrawal phase, A2). A pilot study was conducted in order to determine the effectiveness of the recording and analysis procedures.

## SUBJECTS

### Description of the teacher

The teacher was a fifty-one year old female with approximately twenty years teaching experience, seventeen of which had been in teaching children with disabilities in the same school where the research was conducted. Her professional preparation included a three year teaching diploma.

### Description of the AAC user

The AAC user was a 4,8 year old male. He had no siblings and his home language was Afrikaans. His primary disability was described as a developmental delay with ataxia as an additional complication.

Before the digital speaker was implemented he was exposed to PCS (picture communication symbols) during therapy and could use it to express a few basic needs. He did not use it in the classroom, however, but depended on vocalisations and gestures to communicate. His expressive vocabulary was less than 15 words and consisted of the

words mother, grandmother as well as his teacher's name. He voluntarily used vocalisations to express desires, gain attention, maintain contact during an interaction, express denial and protestations, to obtain an object as well as to comment on an event. He visually attended to others, tracked moving objects and maintained eye-contact during interactions in all environments and situations. He also sometimes turned his head away as a signal that he did not wish to engage in interaction. He often used intentional gestures to manipulate the environment around him and he would respond to the use of gestures by others. He primarily used gestures to gain attention, direct attention to a specific object or event and to communicate a basic need. The use of recognisable facial expressions also occurred spontaneously and appropriately in all situations. He often used facial expressions to indicate a response to questions and statements. He spontaneously initiated interactions with peers and certain, familiar adults but did not exhibit appropriate turn-taking behaviours. Furthermore he was not able to repair conversational breakdowns or provide revisions of unclear messages.

According to the *Word-Findings Vocabulary Scale - Revised*, (Renfrew, 1972) he obtained a score of zero for his expressive vocabulary as he could not name any of the items in the test. The speech therapist and the teacher agreed that this was a reliable reflection of his expressive language abilities. According to the *Peabody Picture Vocabulary Test - Revised*, (Dunn & Dunn, 1981) his score placed him in the lowest possible category. The speech therapist, however, did not consider the test to be an accurate reflection of his receptive vocabulary as he did not co-operate during the evaluation. However, an in depth analysis (by the researcher) of his functioning within the classroom context (in terms of the vocabulary he could understand as well as the types of commands that he responded correctly to) placed him on a level more or less equivalent to that of a three year old child. A large discrepancy, therefore, existed between his expressive language abilities and his receptive language abilities. Hearing tests revealed normal, bilateral hearing.

### Description of the whole class

This study was conducted at a school for children with special needs. The school caters for Afrikaans as well as English pupils and has three levels, namely a beginner's phase, a junior phase as well as a senior phase. For the purpose of this study each of the children in the class was described by a speech language pathologist (Table 1). These descriptions were important as they formed the basis for the differentiation between the children who had limited or no functional speech and the children who were speaking. The information was obtained by means of observations and formal testing as well as from the school records. As shown in Table 1, there were three children who had less than fifteen words in their verbal expressive vocabulary (children with LNFS). An AAC device was implemented for one of these three children (child A).

## PROCEDURES

### Teacher training procedures

Training took place at the school where the research was completed. Prior to the training sessions consent was obtained from the school principal for the participation of the

teacher, by means of a formal letter. The letter explained the teacher's participation in the research project and the importance of the training sessions for the benefit of the AAC user. An informal, friendly atmosphere was created during the training with the use of flowers, refreshments and an informal conversational style (Knowles, 1983). The training involved the teacher as well as the AAC user. The other children in the class were not involved in the training sessions so that the trainer could focus on developing the teacher's skill in interacting with the AAC user.

Five training sessions of one hour each were held on five consecutive days from 11h00 - 12h00. The time of day was chosen to coincide with the break time so that the teacher was without responsibilities and could give her undivided attention to the training. The sessions took place in a separate room that was familiar to the teacher as well as the AAC user. Training was done on a one-to-one basis to accommodate the teacher as it was felt that she would be more comfortable with this arrangement. The training sessions included some theoretical discussions as well as some practical sessions where the teacher had to apply the theory in a real-life situation with the AAC user. This was done to ensure that the teacher would be able to use her newly acquired skills in the classroom.

#### **Content of training sessions**

A description of the content of the training sessions is given in table 2. From this table it is clear that the training sessions concentrated on the development of operational as well as strategic skills. The focus was on the practical implementation in the classroom context.

#### **Data collection procedures**

During each phase six recordings were made of the teacher interacting with the whole class and six recordings

were made of the teacher interacting with the AAC user on an individual basis. Each of the recordings was approximately fifteen minutes in length and took place between nine and nine thirty in the morning. The curricular activity with which the class was busy during that time was "story time". This activity was chosen because it provided the researcher with the best opportunity for observing the teacher in interaction. The recordings took place on Mondays, Wednesdays and Fridays. All the messages that were recorded onto the VOCA were selected by the teacher in order to suit the story. It was decided that the teacher should select the messages to be recorded onto the device so that any changes in the types of utterances recorded could be measured and discussed. The messages were recorded onto the digital speaker prior to the start of the sessions. During the second research phase (post-implementation phase, B1), the speech therapist recorded the messages onto the device. After the training sessions were completed, however, the messages were recorded on to the device by the teacher. The group as well as individual recordings were done in the AAC user's classroom. The group recordings were completed first, after which followed the individual recordings. The classroom assistant engaged the other children in activities such as drawing in the work area in the west end of the classroom while the teacher and the AAC user remained in the "story time" area in the east end of the room for the individual sessions. A video recording was made while an audio cassette recorder, which was attached to the teacher with a harness, was used to make an audio soundtrack. After the recordings were completed they were transcribed and analysed by the researcher as well as by an independent transcriber.

#### **MATERIAL AND EQUIPMENT**

The stories "Goldilocks and the three bears" (Creative Child Press, 1990), "Where is Otto" (Hill, 1992) and "Otto

**TABLE 1: A summary of parameters for each child**

PARAMETERS	DESCRIPTION								
	A	B	C	D	E	F	G	H	I
Child	A	B	C	D	E	F	G	H	I
Chronological age (Jan 1996)	4,8	3,0	3,0	4,0	3,6	3,4	3,10	3,5	3,0
Home language	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans	Afrikaans
Primary disability	Developmental delay	Cerebral Palsy	Cerebral Palsy	Developmental delay	Cerebral Palsy	Developmental delay	Cerebral Palsy	Cerebral Palsy	Mentally Impaired
Additional complications	Ataxia	Squint	Squint	Cleft lip and palate	None	None	Epilepsy	None	None
Primary means of communication	AAC (digital speaker)	Full sentences	Phrases	Full sentences	Phrases	Vocalisations	Single word utterances	Full sentences	Gestures
Verbal Expressive vocabulary	Less than 15 words	More than 50 words	20-40 words	More than 50 words	More than 50 words	Less than 15 words	20-40 words	more than 50 words	less than 15 words
Use of gestures for symbolic communication	Yes	No	No	Yes	Yes	No	No	No	Yes

goes for a walk" (Hill, 1992) as well as pictures from the stories were used during the training sessions.

The researcher made use of overlay grids with 4 spaces for pictures while making overlays during the training sessions as well as during the classroom interactions.

A list of types of interactions as well as a list of types of questions was used for training the teacher in the use of a variety of utterance types as well as for analysing the data that was obtained during the forty-eight classroom interactions.

TABLE 2: Contents of individual training sessions (occurred between phase B1 and B2)

Day	People Present	Aims	Theoretical Discussions	Practical Sessions	Equipment Used
1	- teacher - trainer	- improve operational skills with regards to the digital speaker and making overlays - increase awareness of different utterance types - teach strategies for adapting to the individual child	- technical working of the digital speaker - needs and abilities of the individual AAC user - different types of interaction	- the teacher and trainer went through the story and selected relevant pictures for the grid and then recorded messages and adjusted the volume	- grid - story book - pictures - digital speaker
2	- teacher - trainer - AAC user	- improve skill at using different utterance types - teach strategies for selecting appropriate overlay items	None	- a recording was made of the teacher telling the AAC user a story. - the recording was used to prompt a discussion on the use of different utterance types and overlay items	- story book - story overlay - tape recorder - tape - digital speaker
3	- teacher - trainer	- improve skill at using a variety of questions - teach strategies for using questions for a variety of reasons	- the importance of the use of questions in the classroom - different types of questions	- the teacher went through the story and selected relevant pictures for the grid, recorded the messages and adjusted the volume - the trainer only prompted	- grid - story book - pictures - digital speaker
4	- teacher - trainer - AAC user	- improve skill at using different utterance types - teach strategies for selecting appropriate overlay items	None	- a recording was made of the teacher telling the AAC user a story, using the story overlay - the recording was played back and the teacher's use of different question types and overlay items was discussed	- story book - story overlay - tape recorder - tape - digital speaker
5	- teacher - trainer - AAC user.	- improve technical skills with regards to the digital speaker and the making of overlays as well as the use of various types of utterances and questions - teach strategies for adapting the digital speaker to the child as well as selecting appropriate items for the overlay	None	- the teacher made a story overlay without assistance - a recording was made of the teacher telling the AAC user a story, using the story overlay - the recording was played back and the teacher's use of different utterance and question types was discussed - the number of items on the overlay, the length of the messages as well as how the AAC user coped was discussed	- grid - story book - pictures - story overlay - tape recorder - tape - digital speaker

Twenty-five TDK D60 tapes, a Phillips D628 cassette recorder, a Panasonic NV-S20B video camera, forty-eight VHS video cassettes as well as an Aiwa condenser lapel microphone were used to record the training sessions as well as the classroom interactions.

A Blackhawk digital speaker from Adam Lab was used as the voice output device for the AAC user, during the training sessions as well as during the classroom interactions.

## DATA ANALYSIS PROCEDURES

### Transcriptions

The audio soundtrack was transcribed verbatim and the video screen display was used to clarify to whom each statement had been addressed. The external rater simultaneously made an independent transcription and analysis, and points of disagreement were reconsidered until 100% agreement was achieved. In order to ensure that the raw data was transcribed consistently correctly by both transcribers, certain transcription rules were followed (Stuart, Vanderhoof & Beukelman, 1993). Repetitions of words were included; vocalisations that were not actual words were represented and transcribed in a consistent form, e.g. mhhmm, uhhuh, huhuh, mmm, uh, ah, aw, whoop; numbers were typed as proper nouns; contractions were typed as such that the proper form was spelled out only when it was spoken that way, e.g., don't was typed as don't and do not was typed as do not; standard abbreviations were included, e.g., Dr./Mrs.; during the transcription of a communication segment that was unintelligible and the entire segment was skipped even when a few intelligible words were available. A spell checker was used on all transcripts before proceeding with further analysis.

### Analysis of categories

After the audio recordings of the interactions had been transcribed verbatim the researcher determined the types of verbalisations that the teacher directed at each child. Twelve types of verbalisations had been defined (adapted from a study by Romski, Sevcik, Reumann & Pate, 1989), and the teacher's verbalisations during each session were categorised accordingly. The teacher's choice of utterances to be recorded on the digital speaker, for the AAC user, for each story session, was also categorised according to the twelve types of verbalisations. The twelve types of verbalisations are as follows:

1. *Questioning*: A sentence adapted by order of words, punctuation or intonation to elicit information (e.g. "Is it a shirt? Sharon? Tell me...").
2. *Attention directing*: To guide the child's thoughts to a specific topic (e.g. "Look here").
3. *Answering*: A reply to a child's verbalisation, but not merely negating or affirming (e.g. "Yes you may").
4. *Requesting*: Asking for an action, object or comment, but not a question (e.g. "Fetch me the cow").
5. *Imitating (the child)*: To mimic the child's utterance, with or without expansion (e.g. "I want" "I want").
6. *Naming*: To designate an object or action (e.g. "It's a shirt").
7. *Negating*: To imply that what the child said or did was wrong (e.g. "No it's not a shirt, Uh-uh").
8. *Affirming*: To imply that what the child said or did was

right (e.g. "You are very clever").

9. *Greeting*: A salutation (e.g. "Hello friends").
10. *Self-repetition*: To reproduce one's own verbalisations in more or less the same form (e.g. "What is it? What is it?").
11. *Informative*: To state facts or opinions about a certain topic (e.g. "They run with these pants").
12. *Uncodable*: The utterance does not fall into one of the above communication function categories (e.g. "Huh?" or an incomplete sentence).

Utterances categorised as questioning were analysed further according to Bloom's taxonomy, (Wilson, Lanza & Barton, 1988). The categories within Bloom's taxonomy are as follows, namely:

1. *Level 1 - knowledge*: The simple recalling of information that was given earlier (e.g. "What happened in this picture?").
2. *Level 2 - understanding*: The awareness of interpretation abilities. This includes explaining the meaning of a word as well as answering why questions (e.g. "What is this?").
3. *Level 3 - application*: Applying what is already known or previously learnt in a different context (e.g. "Do you like porridge?").
4. *Level 4 - analysis*: The ability to break information down, into its separate elements to determine the interrelatedness of the elements (e.g. "Why were the bears cross with Goldilocks?").
5. *Level 5 - synthesis*: The integration of elements into a meaningful whole (e.g. "What did Goldilocks do in the house?").
6. *Level 6 - evaluation*: Requires a well motivated critical evaluation of or reflection on the material (e.g. "What should Goldilocks have done when she saw that nobody was home?").

### Statistical analysis

A bar chart was used in order to display the utterance types that the teacher directed at the speaking children in comparison with the utterance types that she directed at the children with LNFS. A bar chart was also used to compare the types of questions that the teacher directed at the AAC user during the different research phases. EWMA charts were used to display changes in the teachers use of answers and imitations during the four research phases. An EWMA chart for quality control detects a shift in the standard deviation of 0,50 within 12 observations and can, therefore, highlight where significant changes occurred. Pie charts were used to display the types of messages that were recorded, by the teacher, onto the AAC device.

## RESULTS AND DISCUSSION

### TYPES OF INTERACTIONS USED

Figure 2 gives an overview of the types of utterances that the teacher directed at the children in the class. The figure indicates which three utterance types were directed most frequently at each of the individuals. In other words, of all the utterances directed at a particular child during the research (100%) the proportions of the three utterance types that were most frequently directed at the child are

given in Figure 2. The teacher's interactions with each of the children with LNFS (child A, child F and child I) is characterised by the frequent use of requesting (such as "Show me") and attention directing (such as "look there"). Although child A, the AAC user, had access to a device during three of the four research phases the teacher's interactions with this child still contained a large proportion of requesting and attention directing. The teacher's interactions with the speaking children (child B, child D, child E and child H), however, is characterised by the frequent use of answering (such as "because if he doesn't put a jersey on he will get cold") and affirming (such as "yes, he is a naughty dog"). There is, therefore, a trend in the differences between the types of interactions that the teacher directs at these two groups (children with LNFS and speaking children) of children. Although the teacher's interactions with the AAC user (child A) resembles her interactions with the other children with LNFS the teacher also directs a large proportion of affirming utterances at the AAC user. This is an utterance type that was frequently directed at the speaking children. The teacher's interactions with the AAC user, therefore, resemble the interactions with the children with LNFS as well as the interactions with the speaking children. The teacher's interactions with the children with LNFS as well as with the speaking children did not change significantly during the four research phases.

The results of this study correlate with previous research findings which found that the quality of interactions directed at speaking children differs from the quality of interactions directed at the children with LNFS (Mirenda & Donnellan, 1986). A previous study that was conducted by the authors indicated that the type of interactions used by the teacher is affected by the child's level of verbal output (Popich & Alant, 1997). Research has also indicated that teachers use more direct questions, attention directing and requests as well as less answers, imitations and praise with children with LNFS (Romski, Sevcik, Reumann & Pate, 1989; Cicognani & Zani, 1992).

Although the teacher's interaction with the other children in the class was consistent over the entire period of research, the teacher's interaction with the AAC user (child

A) was not consistent over the entire period of research. In the teacher's interaction with the AAC user, the use of some utterance types such as answering and imitating varied during the four research phases. The EWMA chart was used to display patterns in the teacher's use of answering and imitating with the AAC user in the group sessions and in the individual sessions. The EWMA chart for quality control should detect a shift in the standard deviation of 0,50 within 12 observations. Increases or decreases in the frequency of occurrence of a certain utterance type are therefore displayed.

Figure 3 displays patterns in the teacher's use of answering and imitating with the AAC user. The x-axis represents the measurements over time (twenty-four individual sessions as well as twenty-four group sessions were analysed). Measurements one to six occurred during phase one (pre-implementation phase), measurements seven to twelve occurred during phase two (post-implementation phase), measurements thirteen to eighteen occurred during phase three (post-training phase) and measurements nineteen to twenty-four occurred during phase four (post-withdrawal phase). The y-axis represents the percentage of answers or the percentage of imitations that were used during each classroom interaction. In other words, of all the utterances that were directed at the AAC user during a specific session (100% for each session) the proportion of answers or imitations that occurred during each session is presented in this figure. The percentages for each session can be compared with the percentages obtained during other sessions in order to determine trends. Trends in the teacher's use of answering utterances with the AAC user during the individual sessions can be seen in the graph. There is a dramatic increase in the use of answering from measurement thirteen. The five training sessions were held in between measurements twelve and thirteen. This means that the teacher used answering more frequently after the training sessions. A similar change in the use of answering can be seen in the teacher's interactions with the AAC user during the group sessions. During the second half of the research, in the individual sessions as well as in the group sessions, the teacher used answering utterances more fre-

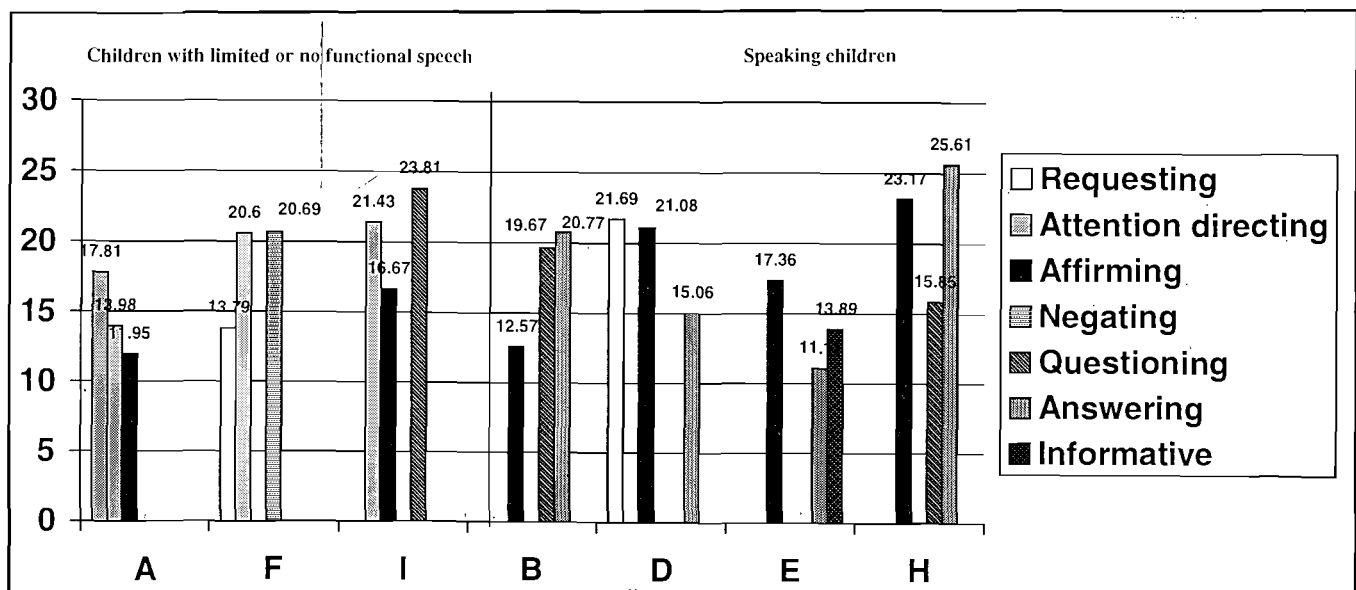


FIGURE 2: An overall comparison between the types of interactions directed at the children with limited or no functional speech and the speaking children

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quently. Contrary to the change in the teacher's use of answering the use of imitating utterances already increased after the implementation of the AAC device. There is an increase in the teacher's use of imitating utterances during individual sessions as well as group sessions from the seventh measurement. In other words, not only did the voice output device enable the AAC user to interact, but it also resulted in an increase in utterances that were as a result of the AAC user interacting (teacher imitating the AAC user).

**TYPES OF QUESTIONS USED**

Questioning is one of the most important and most frequently used teaching strategies. It is, however, important to look at the types of questions that are used as they could significantly influence the amount of initiations made by the children, the types of responses given, the amount of learning and the level of thought obtained (Cicognani & Zani,

1992; Fowell & Lawton, 1992; Greenberg & Woodside, 1994).

Figure 4 displays the teacher's overall use of different types of questions for each research phase. There is no significant difference between the teacher's use of questions in the pre-implementation phase and the post-implementation phase. During both these research phases the teacher only used three types of questions, namely, knowledge, understanding and a small percentage of application questions. According to Bloom's taxonomy these three types of questions are the lowest three cognitive levels of questioning. After the teacher received training, however, there was a noticeable change in the use of questions. During the post-training phase and the post-withdrawal phase the teacher used questions on all six cognitive levels, with the majority of the questions on level 3 (application). Although the teacher used all six types of questions in the post-training and post-withdrawal phases only a small percentage were on the higher cognitive levels (level 4, level 5 and level 6).

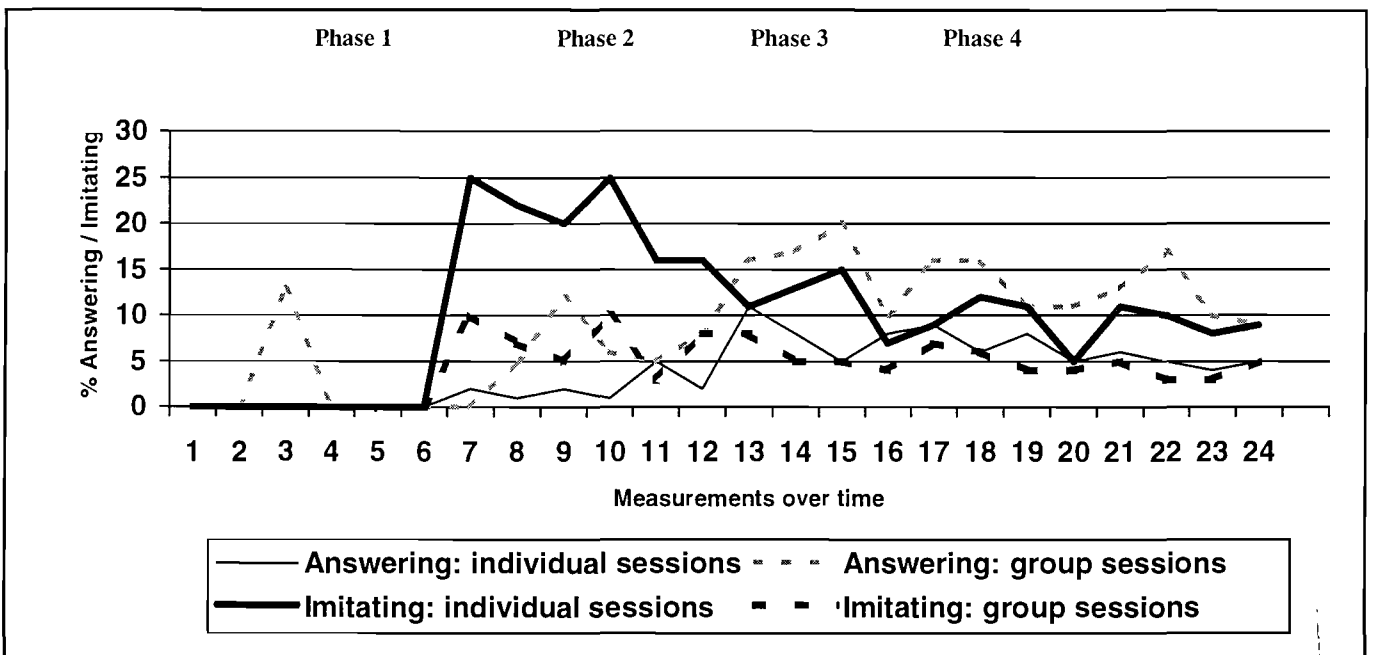


FIGURE 3. The teacher's use of answering and imitating with the AAC user during individual and group sessions

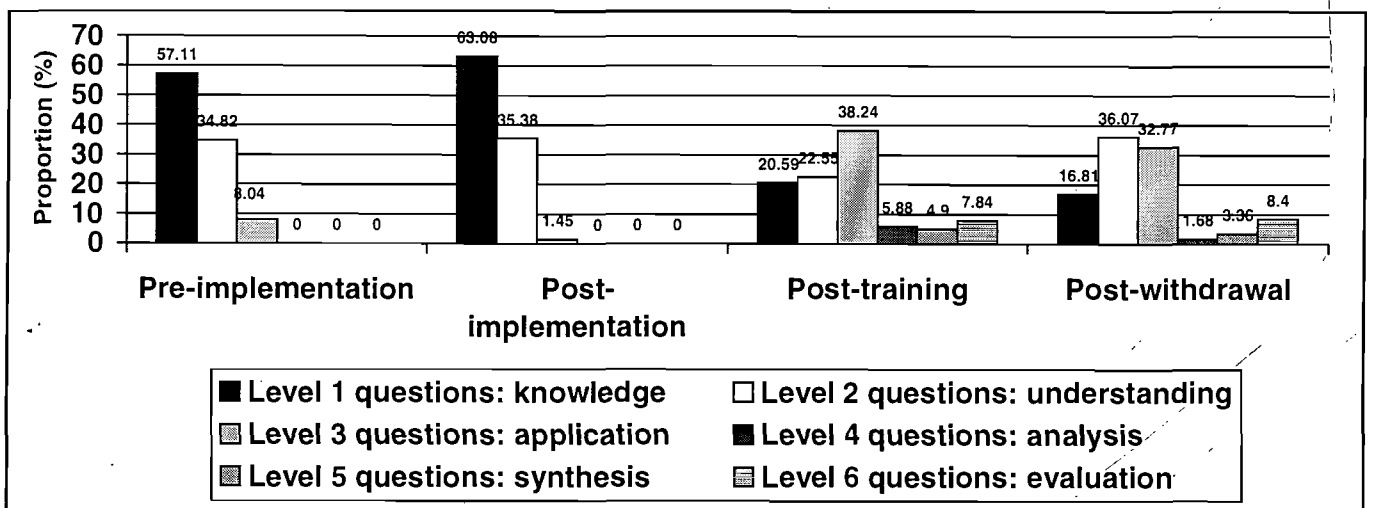


FIGURE 4. The teacher's overall use of different types of questions with the AAC user during each phase



**MESSAGES RECORDED ONTO THE DIGITAL SPEAKER**

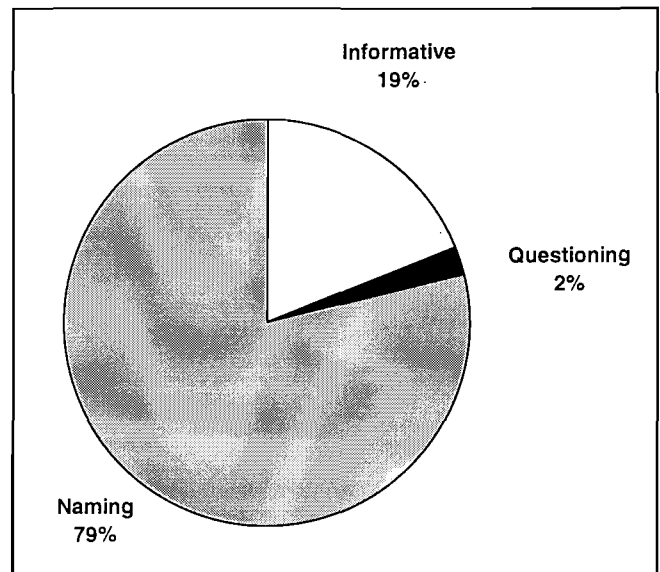
During each of the research phases where the AAC user was using the VOCA in the classroom (phases B1, B2 and A2) the teacher had to decide what messages to record on to the device. The messages that were recorded on to the device would determine the AAC user's access to relevant material so that he could participate in classroom discussions. The presence of certain types of messages such as answering messages as well as the variety of message types can be seen as a means of determining the extent to which the device was being utilised in the classroom.

Figure 5, Figure 6 and Figure 7 display the types of messages recorded onto the digital speaker during the post-implementation phase, the post-training phase and the post-withdrawal phase during group as well as individual sessions. During the post-implementation phase (Figure 5) the teacher recorded a limited variety of messages (naming, informative and questioning) and the largest proportion was naming (79%). After the teacher received training, however, a larger variety of messages were recorded (Figure 6) and the percentage of naming messages decreased to 2%. The largest proportion of the messages, during the post-training phase (Figure 7), was answering (29%). After the period of withdrawal the answering messages decreased to 7% and the naming messages increase again to 13%. Furthermore, a couple of previously unused message types (negating=2% and greeting=2%) also occurred. The increase in the number of different message types with each consecutive research phase indicates that the AAC user had access to a greater variety of utterance types and could express himself better. Furthermore, the increase in the number of different message types in the final two phases of research correlates with the increase in the teacher's use of a greater variety of question types. After the training sessions the teacher was, therefore, more aware of the number of different types of messages that could be recorded as well as the range of questions that could be used in order to facilitate the AAC user's language development.

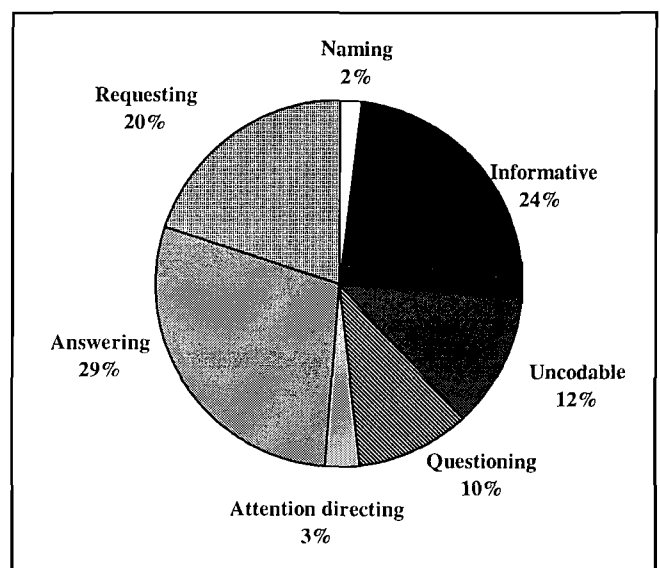
**CONCLUSION**

The quality of interaction that was directed at the speaking children was different to the quality of interaction that was directed at the children with LNFS. The teacher's interaction with these children was characterised by the frequent use of requesting and attention directing while the interaction with the speaking children was characterised by the frequent use of answering and affirming. The implementation of the AAC device (phase B1) resulted in an increase in the teacher's use of imitating and answering with the AAC user. After the teacher had received training (phase B2) there was a further increase in the use of answering. These responses by the teacher, to the AAC user's initiations can be seen as encouragement to the AAC user to participate. According to a study done by Hart and Risley (1995) children who receive input that is responsive and encouraging perform significantly better. The implementation of the digital speaker and the training of the teacher in the use of different utterance types resulted in the creation of a richer language environment for the AAC user.

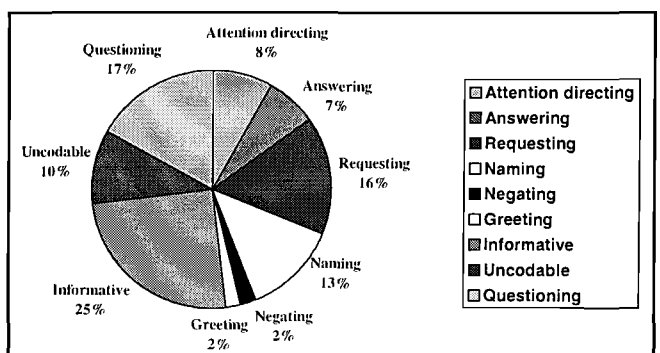
Although the implementation of the AAC device resulted in an increase in the teacher's use of imitation and answer-



**FIGURE 5: The types of messages recorded into the digital speaker during the post-implementation phase**



**FIGURE 6: The types of messages recorded onto the digital speaker during the post-training phase.**



**FIGURE 7: The types of messages recorded onto the digital speaker during the post-withdrawal phase**

ing with the AAC user the teacher's interaction with the other children in the class remained the same throughout the four research phases. As mentioned previously the AAC user was not the only child in the class with LNFS. The fact that the teacher's interaction with the other two children with LNFS did not change as a result of the training that the teacher received is interesting. This confirms the notion that skills acquired while working with a particular child with LNFS do not automatically carry over to other children. Although one could argue that the other students with LNFS did not have the same access to messages as they did not use VOCAs, the trend in the behaviour of the teacher could indicate the limitations of technology focused training for implementation. The question of how to ensure that AAC implementation is beneficial for the whole class must be considered!

Not only was the teacher's use of interaction types influenced by the training sessions but the teacher's use of questions was also influenced. The teacher's use of questions on higher cognitive levels was positively influenced by the training sessions. This means that implementation of an AAC device alone will not result in the best possible interactional environment. Training of the interactional partners should be part of the implementation process. This underlines the importance of training for the teacher of an AAC user in order to increase the AAC user's exposure to interactions that result in maximum cognitive development.

The teacher did not spontaneously record a variety of messages onto the digital speaker. The AAC user only had access to a limited variety of utterance types until the teacher received training. One can see, by the teacher's choice of a greater variety of messages on the AAC device that, by the final two research phases, the teacher had become more sensitive to the needs of the child. Access to a limited variety of utterance types could impair the AAC user's participation and development. It is, therefore, critical that the teacher of an AAC user should receive adequate training on the selection of appropriate items to be included on the device display. Research has found that AAC users in residential settings direct less than 5% of their interactions at communication partners who have not received formal training (Dalton & Bedrosian, 1989). Formal training of communication partners, therefore, forms a critical part of the AAC implementation process.

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