

Research Title:

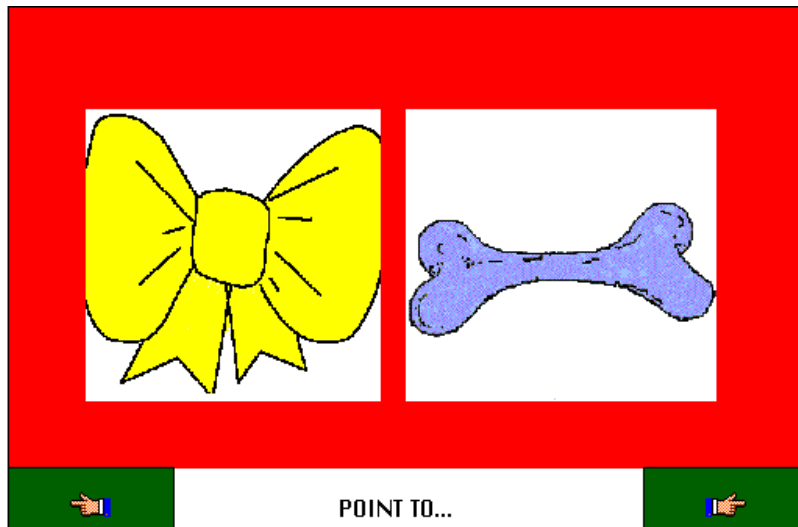


A comparison of a computerized minimal pairs treatment program using drill and practice method versus game format in the remediation of phonological processes in children

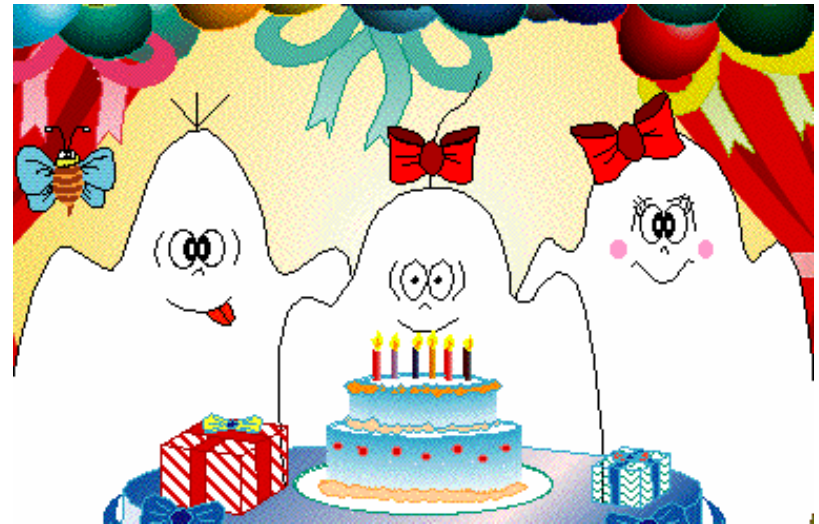
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Computerized Minimal Pairs treatment programs:

Drill & Practice method



Game format



General nature of the problem



- Both traditional and computerized treatment programs were equally effective in the suppression of phonological processes Parsons and Shaw-Stuart (1992).
- Current computerized drill and practice programs receive much criticism
 - criticized for being unpleasant and do not capitalize on the full potential of the computer.
 - a scarcity of quality treatment software.

Introduction



- An educational computerised minimal pair treatment program called “boo” was developed by the author for this research following the criteria delineated in the literature and recommendation in Lisa & Carl’s research.
- The influence of individualised learning and the game format were incorporated into their drill and practice tasks in the development of the program.

Aims of the research



- to compare the effectiveness of two computerised software programs which improve the pronunciation skills of children.
- To investigate the relationship between the learners' level of support by either the speech therapists or the parents in using computerized treatment programs.

What is Phonology?



- Phonology deals with the system of speech sounds and the rules governing their use.
- Spoken language consists of ordered sequences of phonemes that are segmented into words.
- The phoneme is the minimal significant unit of sound. e.g. the following words are the same except
 - beginning phoneme: bat, cat, hat, mat.
 - medial phoneme: sit, sat, set, seat.
 - final phoneme: bat, back, bad, bag;

Tasks for language learning



- Language learning on the phonological level involves two interrelated tasks:
 - learning to produce the various phonemes of the language.
 - learning the rules that dictate how they can be combined into words.
- Children learning to speak do not pronounce many of their words the way that adults do. They simplify them, often by omitting and substituting for phonemes they have difficulty producing.

What is Phonological Process?



- A phonological process is a mental operation that “applies in speech to substitute for a class of sounds or sound sequences presenting a common difficulty to the speech capacity of the individual, an alternative class identical but lacking the difficult property” (Stampe, 1979).
- These processes were referred to as “kinds of changes which apply to classes of sounds, not just individual sounds, that children make in simplifying adult speech” (Ingram, 1981)

Phonological Processes



- The concept of phonological process in the clinical assessment of child speech is applied primarily as a descriptive device that identifies or analyzes systematic patterns in children's pronunciations by comparison with the target adult pronunciations.

Types of Phonological Processes



- There are three phonological processes, which are commonly occurring and should be suppressed by the time children reach school age (Khan & Lewis, 1984).
 - “final consonant deletion”
 - “stopping of fricatives and affricates”
 - “fronting of velars and palatals”

Final Consonant Deletion

- Final Consonant Deletion is a process that describes the omission of final consonants.
- For examples:

<i>bus</i> [bʌs] → [bʌ]	<i>robe</i> [roub] → <i>row</i> [rou]
<i>bed</i> [bed] → [be]	<i>cord</i> [kɔd] → <i>core</i> [kɔ]
<i>bin</i> [bɪn] → [bɪ]	<i>time</i> [taɪm] → <i>tie</i> [taɪ]
	<i>paint</i> [peɪnt] → <i>pay</i> [peɪ]

Stopping of fricatives and affricates

- Stopping of fricatives and affricates is a process whereby target fricatives and affricates are replaced by homorganic stops.
- For examples:

/f/ → [p]	/z/ → [d]
/v/ → [b]	/ʃ/ → [t]
/θ/ → [p/t]	/ʒ/ → [d]
/ð/ → [b/d]	/tʃ/ → [t]
/s/ → [t]	/dʒ/ → [d]

Fronting of velars and palatals

- Fronting of velars and palatals is a process which involves a change in the place of articulation of the target consonant to a more anterior placement.
- For examples:

Fronting of Velars stops to alveolar placements	Fronting of palatals to alveolar placements
/k/ → [t]	/tʃ/ → [ts]
/g/ → [d]	/dʒ/ → [dz]
/ŋ/ → [n]	/ʃ/ → [s]
	/ʒ/ → [z]

Speech characteristics of phonologically disordered children

- They have a reduced inventory of sounds;
- The syllable structure of their words is simple;
- Least accurate in their production of fricatives, affricates, liquids, and clusters;
- The persistence of idiosyncratic processes;
- Different sequence of acquisition;
- Fail to maintain phonemic contrasts. Stoel-Gammon and Dunn (1985, p.127)

Relationship between phonological disorder and the acquisition of literacy



- Children with relatively minor delays in reading abilities in the early years of school are described as being at a high risk of further academic failure (Department of Education, 1997; Stanovich, 1986).
- Up to 20% of the population continue to have reading problems into adulthood (Blachman, 1991).

Computer and language intervention



- Advocates for the use of computers in the field of speech pathology are also on the rise.
- The potential benefits of using computer with children has been recognized by a number of researchers (Barker & Torgesen, 1995; Katz & Wertz, 1997).
- It has been found that children prefer the computer mode of delivery to the clinician mode of delivery (Shaw-Stuart & Parsons, 1994; Shriberg, Kwiatkowski, & Synder, 1989; 1990).

Computer and Language Intervention

- from the learner's point of view



- The computer seems to be intrinsically motivating (Goldenberg et al., 1984).
- Gaining control over learning.
- With infinite patience and in a non-threatening manner, failure-free mastery of new skills can be attained while reinforcing and supporting prior attainments, providing the user with a sense of **increased competence** (Budoff & Hutton, 1982; Goldenberg et al., 1984).

Intrinsic motivation



- Intrinsic motivation generates behaviors that seek to control one's environment and that convey a sense of competence (Deci, 1975, 1980; Deci & Porac, 1978).
- Individuals choose to engage in activities that appear challenging and attainable. While engaged in these activities, children derive competence information based on the success of their interactions. The resultant feelings of competence are a type of intrinsic reward (Schunk, 1991).

Computer and Language Intervention

- from the Speech Pathologist's point of view



- Computers have the potential to make efficient use of the Speech-Language Clinician's time (Rushakoff & Lombardino, 1984).
- Once a client has mastered basic computer skills, the client can use the computer independently and thus the client has the potential for greater and more flexible access to treatment via the computer (Ahmad, Corbett, Rogers & Sussex, 1985).

Computer and Language Intervention

- from the Speech Pathologist's point of view



- Parents, teachers or volunteers can also be trained to administer the treatment programs at home or at school and reinforce learned skills (Garrett, 1973).
- Speech Pathologist can devote more time to clients who require an interpersonal context for treatment (Rushakoff & Lombardino, 1986; Parsons & La Sorte, 1993; Lyons & Parsons, 1994).
- The computer may also provide a form of treatment for clients living in remote areas.

Computer and Language Intervention

- from the Speech Pathologist's point of view



- Activities on the computer can be programmed to be self-paced to meet different speeds of learning (Kidd & Holmes, 1982; Lasky, 1984; Ahmad et al., 1985).
- The process of recording responses, analyzing results and providing feedback to the user provides an interactive learning environment to the user (Ahmad et al., 1985).
- Computers can present auditory reinforcers, visual, or both, while offering limitless variation and simultaneously fulfilling the basic rules of immediacy and consistency (Panyan, 1984).

Computer and Language Intervention

- from the Speech Pathologist's point of view



- Quality computer software programs can even provide an individualized path of instruction (Lasky, 1984; Ahmad et al., 1985; Green, 1986; Hertz, 1987).
- By individualizing the computer program with respect to skill level, a gradual progression of difficulty is allowed.
- Gradual progression of difficulty allows clients to be correct as often as possible and is the fastest way to learn (Holland & Matthews, 1963; Mowrer, 1982).

Minimal Pairs



- Minimal pairs are any two words which become homophones due to a child's speech sound error (Saben & Ingham, 1991)
- Minimal contrast instruction is appropriate when two contrasting sounds in the adult language are collapsed into a single sound unit with the result that no contrast is made (e.g., /t/ replaces /k/), or where segments are deleted, such as in final consonant deletions.
- Training is designed to establish sound contrasts that mark a difference in meaning.

Minimal Pairs



■ Final Consonant Deletion

- | | | |
|------------|----------|-----------|
| – hi/hive | K/cage | two/tooth |
| – Bow/boat | hoe/hose | row/rope |

■ Fronting

- | | | |
|-----------|----------|-----------|
| – Top/cop | fin/thin | date/gate |
| – Tim/Kim | tap/cap | pie/tie |

■ Stopping

- | | | |
|--------------|-----------|-----------|
| – Paw/four | road/rose | two/Sue |
| – toot/shoot | ton/sun | harp/half |

Why use minimal pairs treatment program?



- Phonological processes are said to be primarily linguistic in nature (Weiner, 1981).
- Hence, the treatment for remediating phonological processes should be primarily linguistic in nature (Blache & Parsons, 1980; Weiner, 1981).
- Minimal pairs are used in treatment for the purpose of confronting children with the loss of phonemic contrast that results from their speech-sound changes.

Research Design



- Experimental group studies.
- There are three independent (manipulated) variables controlled by the researcher in this study.
 - The first independent variable is: The computer software programs. There are three types of this variable, namely:
 - Computerized minimal pairs treatment program in drill and practice format.
 - Computerized minimal pairs treatment program “Boo” embedded in game environment.
 - Mathematics computer software.

Research Design



- The second independent variable is:
 - The support given by the speech pathologist. There are two types of this variable, namely:
 - » high support
 - » low support

- The third independent variable is:
 - The support given by parents.. There are two types of this variable, namely:
 - » high support
 - » low support

Research Design



- The dependent (measured) variable in this study is the participants' phonological processes as measured by the scores on the probe test (Parsons and Siu, 1999)
- Probe tests were constructed to determine the subjects' progress for suppression of the phonological processes.

Types of Support



- Criteria for high level support
 - Any technical support needed in running the program.
 - Give encouragement and guidance during the treatment time.
 - Give feedback to the child in addition to those provided by the program.
- Criteria for low level support
 - Give technical support only if the child got stuck.
 - Don't intervene with the child once the program starts.
 - No feedback or guidance during the treatment time.

Research Design

Supervised by	Speech Pathologist		Parents	
	Low	High	Low	High
Program\Type of support				
Computerised minimal pairs treatment program 1 (drill and practice)	N=6	N=6	N=6	N=6
Computerised minimal pairs treatment program 2 (games embedded)	N=6	N=6	N=6	N=6
Mathematics program (Control Group)	N=6	N=6	N=6	N=6

Research Questions



- Would there be significant differences between the change in phonological processes of the participants using the drill & practice and the game embedded computerised minimal pairs treatment program?
- Would there be significant differences between the change in phonological processes of the participants given high levels of support and those given low level of support when using the computerized minimal pairs treatment programs?

Research Questions



- Would there be significant differences between the change in phonological processes of the participants given high levels of support by speech therapist or by parent when using the computerised minimal pairs treatment programs?

Hypotheses



- 1.1 H_0 : There would be no significant differences between the change in phonological processes of the participants using the drill & practice and the game embedded computerised minimal pairs treatment program.
- 1.2 H_1 : There would be significant differences between the change in phonological processes of the participants using the drill and practice and the game embedded computerised minimal pairs treatment program.

Hypotheses



- 2.1 H_0 : There would be no significant differences between the change in phonological processes of the participants given high levels of support and those given low level of support when using the computerised minimal pairs treatment programs.
- 2.2 H_1 : There would be significant differences between the change in phonological processes of the participants given high levels of support and those given low level of support when using the computerised minimal pairs treatment programs.

Hypotheses



- 3.1 H_0 : There would be no significant differences between the change in phonological processes of the participants given high levels of support by parents and those given high level of support by speech therapists when using the computerised minimal pairs treatment programs.
- 3.2 H_1 : There would be significant differences between the change in phonological processes of the participants given high levels of support by parents and those given high level of support by speech therapists when using the computerised minimal pairs treatment programs.

Subject selection



- Children of families who contacted Dr. Carl L. Parsons of about computerised treatment over the the last 12 months.
- Dr. Parsons already had about 50 families who had asked if their children could be involved in such a project.
- These families heard about Dr. Parsons' clinical work which entails the use of computers to remediate language and speech impairments.

Subject Selection



- 72 children diagnosed, as having pronunciation impairment participated in the project.
- All children were those who left off the last sounds in words, although they could say all sounds.
- None of the children have physical disabilities or hearing loss.

Procedures



- All children received a Speech Pathology assessment, which included both formal and informal testing.
- Each child received a 10 minutes probe test by a speech therapist prior to intervention and the score was recorded.
- Then each child received a minimum of 6 weeks of computerized intervention 3 times per week for 15 minutes per session.

Procedures



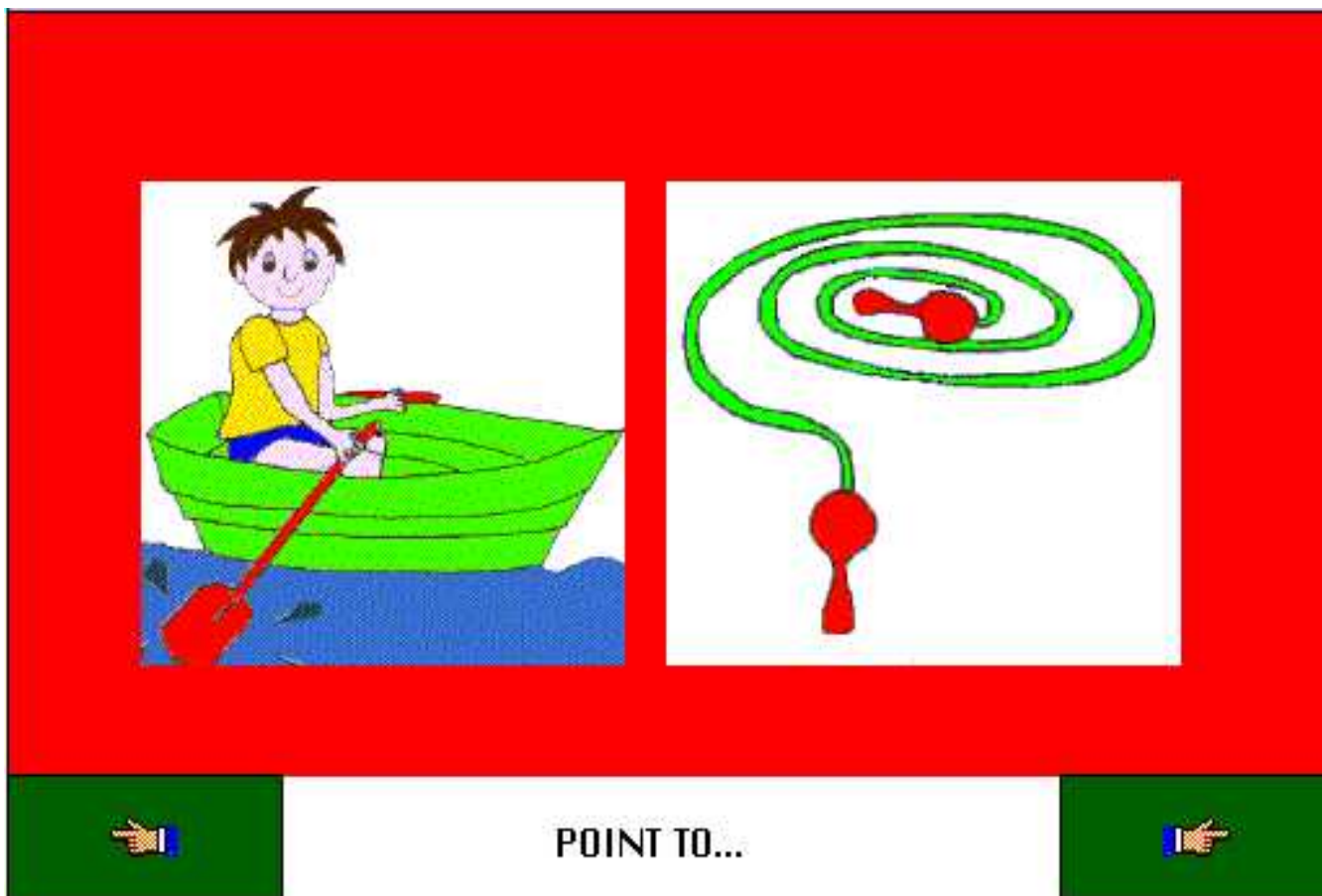
- 36 families were taught to use a software program at home and collect the data.
- Half of the families were encouraged to give a high level of support to the children to ensure that the children got enough feedback and assistance in playing with the program with the parents.
- 36 children were seen by their local speech therapists, who also used a software program with the children.
- Half of this group was also given a high level of support with the speech therapist sitting next to the child throughout the session.

Procedures



- Observations of treatment sessions were conducted.
- The objective of the observation was to find out the children's level of concentration and motivation in running the program and the level of support by parents.
- After the 6 weeks of computerized intervention, the same 10 minutes probe test was given to the child again by the speech therapist to see if there was a change in the score.

The computerised Minimal Pairs Treatment Program (drill and practice)



The image displays a computer interface for a Minimal Pairs Treatment Program. The interface is set against a red background. At the top, there are two white rectangular boxes. The left box contains a cartoon illustration of a young boy with brown hair, wearing a yellow shirt and blue shorts, sitting in a green rowing boat and using a red oar. The right box contains a green spiral line that starts from a red ball at the bottom and winds upwards, ending at another red ball in the center of the spiral. Below these two boxes is a green horizontal bar. On the left and right sides of this bar are small icons of a hand pointing to the right. In the center of the green bar, the text "POINT TO..." is written in white capital letters.

The computerised Minimal Pairs Treatment Program (drill and practice)



- The computerised Minimal Pairs Treatment Program was developed using Hyperstudio 2.1.
- This enables a series or stacks of cards to be developed and linked for interactivity.
- Each card consisted of a minimal pair in picture stimuli.
- The digitised speech, activated by clicking on the picture of the minimal pair word, said, “This is (minimal pair word)”. The computer did not provide instructions or feedback or reinforcement. (See Illustration)

The computerised Minimal Pairs Treatment Program in game format



- The initial plan for this treatment program contained three different sets of games to cover the contents of the three phonological processes of Fronting, Final Consonant Deletion and Stopping.
- The theme of the three sets of games was about a character who needed to go through a stack of story books and scored enough marks in order to become a winner in the story telling competition.

The computerised Minimal Pairs Treatment Program in game format



- The first set of game contained four story books or activities which covered 40 pairs of words in the phonological process of "Stopping".
- The second set of game contained five activities which covered 62 pairs of words in the phonological process of "Final consonant deletion".
- The third set of game contained three activities which covered 35 pairs of words in the phonological process of "Fronting".
- The whole treatment program may therefore contain 12 stories to cover the full list of minimal pairs.

Limitation



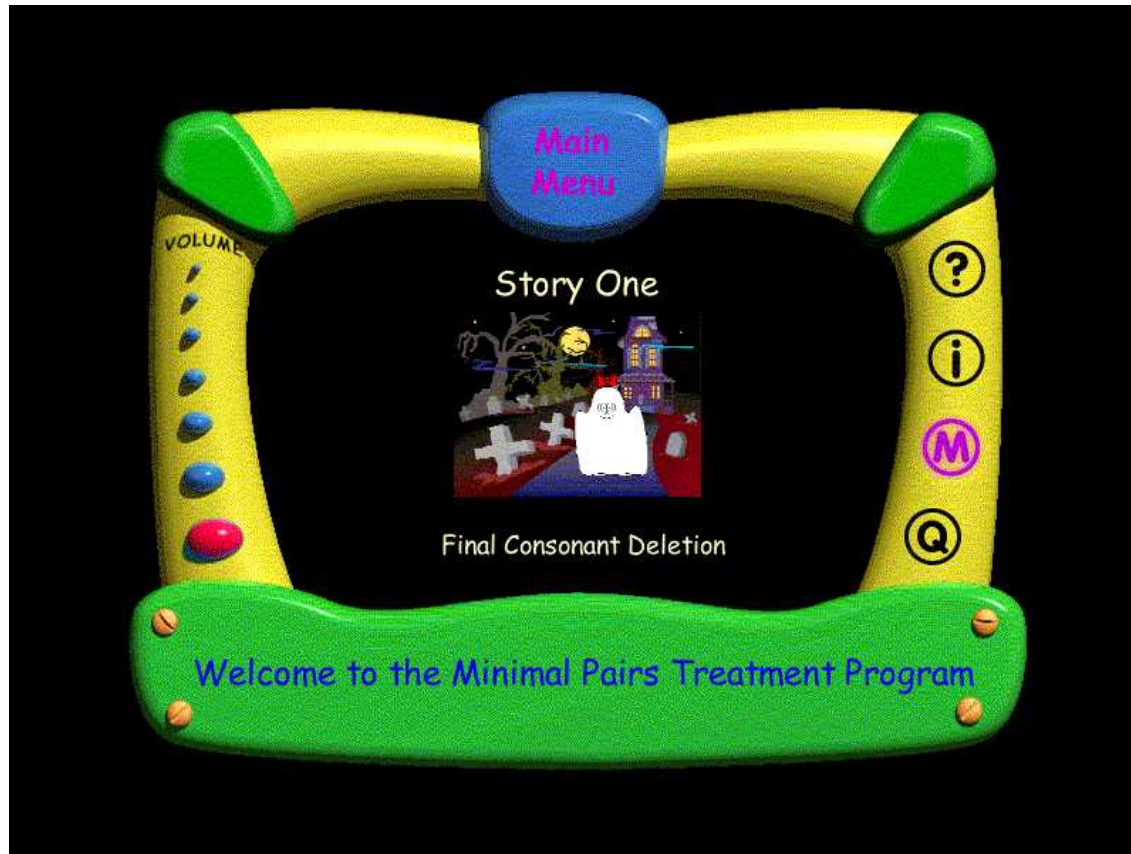
- However, due to the limitation of resources, funding and time, only a sample of one of the story was produced as a template for the rest of the activities. The composed game belonged to the phonological process of Final Consonant deletion and was about a character called "Boo".
- Depending on the feedback and evaluation of this research, it is worthwhile to decide whether a full version of the treatment programs should be developed.

Development of the Computerised Minimal Pairs Treatment Program embedded in game format.



- The computerised Minimal Pairs Treatment Program embedded in game format was developed using Macromedia Director 6.
- Director was a powerful and complex multimedia authoring tool with a broad set of features used to create multimedia presentations, animations, and interactive multimedia applications.
- It required a significant learning curve, but once mastered, was among the most powerful of multimedia development tools.

Development of the Computerised Minimal Pairs Treatment Program embedded in game format.



Probe Test



Probe Test



- Probe tests were constructed to determine the subjects' progress for suppression of the phonological processes.
- The Probe tests for this research were constructed for final consonant deletion only.
- The probe test contained 30 test words.
- 20 words were selected from the relevant treatment pairs.
- 10 words untreated words to determine generalization.

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Hidden independent variables



- Did the time of testing influence the child's performance?
- What was the longest time/shortest time taken to complete the program?
- Examples of questions and difficulties children had?
- Level of motivation of child?
- Children's comments regarding the best and worst features of the software program 'boo'.