Middle-East Journal of Scientific Research 9 (3): 390-396, 2011
ISSN 1990-9233

The Investigation of the Effect of Computer-Assisted Instruction on Treating Language and Pronunciation Disorders in 7-8 Year-Old Children

[1]M. Narimani, [2]H. Mahmodi, [2]M. Abbasi and [3]M.B.M.D. Sotudeh

[1]University of Mohaghegh Ardabili, Literature and Humanities Science, Ardabil, Iran
[2]University of Mohaghegh Ardabili, Ardabil, Iran
[3]Ardabil University of Medical Sciences, Ardabil, Iran

Abstract: The present study aimed at the investigation of the efficacy of computer-assisted instruction, with the purpose of treating the disorders related to the pronunciation and the delay in the Verbal and the language of 7-8 year old children (whether normal or exceptional). The current experimental study was conducted adopting pretest -posttest control group design. The statistical population of this research comprised all the children who had referred to the clinical centers of Verbal therapy of Ardabil in ….. The convenience sampling method was used in the present study. The sample included 60 children which among them 30 cases were assigned to control group and 30 cases to treatment group. The instruments employed in the current study were the questionnaire of articulation disorders of university of California and the Verbal-language disorder questionnaire of the American association of Verbal therapy. The results of study demonstrated that the software for the pronunciation disorders significantly decreased the pronunciation disorder. Moreover, it increased the lexicon, auditory memory and visual memory of the cases.

Key words: Pronunciation disorder · Delayed Verbal and language disorder · Lexicon · Auditory memory · Visual memory

INTRUDUCTION

The evolution of Verbal and language can be regarded as the supreme evolutionary stage of human being. Coordinately, the written and oral behaviors are the superb and exclusive human behaviors. The production of the audible facet of language i.e. Verbal, is a fluid, fast and complicated phenomenon. During the acquisition of Verbal and language, processing of auditory information provides the children with the opportunity of acquiring the fundamentals of language and organizing his phonological system. The phonological information processing in the children with central auditory processing deficiency (The clinical manifestation of this deficiency appears as pronunciation disorder in Verbal; language wise, the disorder manifest itself at the level of syntax; from the aspect of language skills, disorder presents itself in reading and writing) takes place slowly and with difficulty. Nowadays, processing capabilities of computer system and software programs have enabled the Verbal and language pathologists to provide the patients with the Verbal modified in terms of speed, frequency and loudness and tailored to their processing abilities and to help them (by slight modifications) increase their processing ability and attain normal or approximately normal level of processing gradually [1]. Conversational disorder is taken into consideration as one of the critical problems of health issue, since in the childhood causes some problems and in the adulthood makes job opportunities limited and affects the social and economical state of the individuals. The mental process of a child is shaped through interaction with the environment and sharing others experience via language. It is in this case that, the significance of language and the adequate instruction of it becomes clear [2]. Sometimes the delayed Verbal is considered as a natural phenomenon, for example when a child passes the stage prior to one-word stage normally, has a good perception and cognition, has a regular walking, has no auditory problem, is completely conscious and the results of all tests of him/ her (brain, blood, metabolism and hormonal experiments) are normal [3]. External appearance of

Corresponding Author: M. Narimani, University of Mohaghegh Ardabili, Literature and Humanities Science, Ardabil, Iran. Tel: +984515516401, Fax: +984515516402.

language can be observed in two ways of Verbal and writing. Damage to every aspect of Verbal i.e. the dynamic part of language which can be categorized into three categories of articulation, fluency and voice, causes disorders in Verbal. Verbal/ language embraces syntactic, morphological, pragmatic and semantic structures which are employed during Verbal and any disorder in each structure would entail Verbal disorders, such as delayed Verbal and language. This disorder is observed during language acquisition period in a child. The factors that have a hand in appearance of such a disorder are genetical, environmental and innate. Likewise a variety of diseases including paroxysm, phenyl ketonoria, autism....help to the creation of it. Articulation Disorder has been taken into account as a dynamic disorder of Verbal in which the person due to physical or functional: reasons is unable of producing some of the Verbal sounds [3]. The Verbal and language pathologists in American and European countries have designed several software programs for treatment of articulation and delayed Verbal-language disorders and have presented all the effective methods in the form of software for the patients. Computer-assisted instruction is one of the mental rehabilitative techniques of Verbal and language disordered children. Inasmuch as the nature of technology implies facilitation of access and optimization, accordingly, referring to the raw characteristics of computer and instructional software, their presence can be highlighted in special instruction. Computers provide new possibilities including color, sound and motion, which through them the new aspects of the problems can be explored, the instruction can be facilitated and the ability of a child can be increased [4]. Parallel to incremental demand for applying technology in exceptional education, computer assisted instruction have gained a particular position in the research domain. Therefore, the necessity and the significance of the role of computer and computer-oriented activities in teaching-learning process of the learners become more outstanding. Generally speaking, applying technology in special education has been emphasized regarding its positive impact on the self confidence, independence and the self-image of the children with special needs. The proponents of using instructional software programs believe that this operation will bring about normalization, integration and pervasive education [5].

Canadian Association of language pathologists and audiologists developed sounds' pronunciation software which comprised 2500 exercises. This complete set of exercises included morphology, syntax, word retrieval, pronunciation disorder, basic concepts and story telling. They designed the software for those exceptional learners and children who had difficulty in pronunciation. The results showed that the sounds pronunciation software had a major effect on the accurate pronunciation of the sounds in children [6]. Hutchin et al. have undertaken a study using the treatment software of Look and Say, designed by themselves, for children with pronunciation disorder. After six month practice, these children pronounced the most of the phonemes correctly. They suggested application of the software for children with auditory impairment and cerebral contusion [7]. Gray et al designed the software of "Verbal Sounds on Cue" for children suffering from articulation disorder, Apraxia and Dysarthria as well as children with word retrieval difficulty. They tested the software on 32 children's pronunciation of phonemes. The results manifested the impact of software on improvement of pronunciation of Verbal sounds particularly the phonemes which the children mispronounced them. Moreover the software of Verbal sounds on cue had the privilege of a child's being able to observe the articulation system of the therapist while producing the phoneme [8].

American association of Verbal-language developed the software of numbers sounds for children with language problems. The findings showed that the software had a positive effect on instruction of numbers [9]. Smith and John designed the software of Cognitive/logical/ deductive reasoning skills for the children who had difficulty with their memory and cognition. The software consisted of sections as problem-solving, deductive reasoning, memory and visual perception exercises. Finally, the results of the study revealed that children in treatment group outperformed the control group in terms of memory items and logical perception [10]. Lerner and James conducted a study with the purpose of using computer in Verbal-language delay, its improvement and training specialists.

This research was undertaken on the basis of application of believes, concepts and application of computer in instructional programs and methods as well as preparation of specialists for instructing the students with Verbal-language delay disorder. The outcomes of the study indicated the specialist can easily teach the necessary points to the children and save the time of instruction to a great extent, using this method [11].

According to findings of Seferian's study, incorporating application of instructional software with instruction in schools for children with delayed Verbal and language disorder was useful. The study showed the

contributory effect of instructional software on pushing students toward completion of their education [12]. Richard developed the software of sight on sounds for children suffering from pronunciation and Verbal-language disorder. The results of study exhibited a significant effect for the software on the improvement of pronunciation disorder in children ($p<0.01$). Additionally, the study revealed a positive impact on the word retrieval, auditory comprehension skills and Apraxia ($p \leq 0.05$) [12]. The American association of Verbal therapy designed the software of Understanding Questions +Out Loud for the children with comprehension difficulty. This software included more than 500 exercises on the daily activities of a child. The investigations on this therapy software have come up with the effectiveness of software with respect to improvement of the question comprehension of children with delayed Verbal comprehension [13]. Tormanen and Takala have undertaken a research on the efficacy of computer software programs on the children's auditory-visual problems [14]. The results of pretest and posttest revealed that the children with lower age benefitted more from these software programs and they improved regarding reading ability to a great extent. Besides, these instructions had a positive effect on the auditory-visual matching of higher age students. Canadian association of Verbal-language designed the software designated as "Direction following+ out loud". The sample under study included 30 articulation disordered children and 30 language disordered children. The results of the study discovered the major effect of the software on the improvement of memory, auditory comprehension, visual perception, reading and Understanding Questions + Out Load [6]. Therefore, taking into account the results of the conducted studies, the following hypotheses were posed:

- The therapy software of Verbal-language disorder has a significant effect on the decrease of pronunciation disorders in children.
- The therapy software of Verbal-language disorder has a significant effect on boosting the lexicon of Verbal-language disordered children.
- The therapy software of Verbal-language disorder improves the auditory memory of language disordered children significantly.
- The therapy software of Verbal-language disorder has a significant impact on the improvement of visual memory of language disordered children.

MATERIALS AND METHODS

The present experimental study was designed as pretest-posttest control group. The statistical population of the current study included all those children who had referred to the clinical Verbal-therapy center in Ardabil. The sampling method of the current study was of convenience type. The number of participants included in the present study was 60, which were randomly assigned into two groups of treatment and control (30 for each group). The following instruments were employed for the purpose of data collection.

- Articulation disorders Questionnaire of California, which includes the entire alphabet, presents every letter in initial, middle and final positions inside three separate words. The child with the articulation disorder should pronounce each phoneme correctly in all three positions. The scoring is based on the number of errors that a child makes as mispronouncing or substituting the letter. Therefore, The less the score of the child, the less his or her pronunciation problems. The range of scores was between 1 and 75. The reliability and Cronbach's alpha for this questionnaire has been reported respectively, as 0.82 equals 0.78.
- Verbal -Language questionnaire of American association of Verbal and language encompasses assessment of lexicon in a wide range of categories, auditory memory and visual memory. Lexicon includes categories such as fruits, animals, parts of body, colors and geometrical shapes. Both the auditory and the visual memory sections comprise one to five item questions and ultimately the sentence. Among the questions, 50 questions are allocated for lexicon, 25 questions for auditory memory and 25 questions for visual memory. The child receives one point for every correct answer. The reliability of the questionnaire has been reported as 0.79. Computer software: The software designed in the present study, constitutes the following parts: 1- Verbal-language reinforcement exercises including instruction about categories such as fruits, clothing, occupations, animals, geometric shapes, foods, places, colors, insects, numbers, vehicles, body parts of body, kitchen utensils, memory increase, instruction of the sounds. The memory boosting section comprises exercises for auditory and visual memory. 2- Articulation disorder improvement

exercises (including all the letters of alphabet which will be pronounced in the case of being clicked on). By double-clicking on a letter, the exercises related to that letter in initial, middle and final positions of words and the exercises about the letter's function in the sentence will appear. The software was developed by the authors of the present paper. For determining the validity of the therapeutic software of pronunciation and Verbal-language delay disorders, the concurrent validity of software was measured. The obtained correlation coefficient for simultaneous performance of therapeutic software for pronunciation and Verbal-language delay disorders and instructional software of Sama on 30 students with pronunciation and Verbal-language disorders was as r=0.61.

The reliability of the software was calculated by Cronbach's alpha (0.89). In the first place the children with articulation and Verbal delay disorder were recognized. Subsequently, two questionnaires of articulation disorders and "Verbal-language disorder questionnaire" of American association of Verbal-language disorder therapy were administered as the pretest. The treatment group was instructed by therapeutic software for Verbal language disorder of Nava for 10 sessions. During 10 thirty-minute sessions, using software, the children practiced upon mispronounced phonemes. The second thirty minutes of an hour was allocated for lexicon and cognition development. But the treatment group received no instruction during these sessions. At the end of the sessions, both groups took posttest. Subsequently, the obtained data from the current study was analyzed via multi-variate variance analysis (MANOVA).

RESUTS

As it can be observed, the mean and the standard deviation of the control and the treatment groups have been presented in Table 2, in respect of pronunciation disorder, lexicon, auditory memory and visual memory variables in pretest and posttest.

To examine the hypotheses of the present study, the differences between pretest and posttest scores has been displayed in Table 3. The difference was related to dependant variables in the articulation and language disordered group and control group which were analyzed through MANOVA.

Table 1: Demographic characteristics of 7-8 year-old children suffering from pronunciation and Verbal disorders

Variable		Frequency	Percentage
Gender	Male	40	66.66
	Female	20	33.33
Age	7-8 years old	58	96.66
Parents education	Diploma or under-diploma	48	80.00
	Academic	12	20.00

Table 2: The mean and the standard deviation of treatment and control groups in pronunciation disorders questionnaire and in Verbal-language disorder pre-test

		Pretest		Post-test	
Variable	Group	Mean	Standard deviation	Mean	Standard deviation
Pronunciation disorders	Treatment	30.60	2.32	18.03	3.18
	Group control	30.56	2.41	29.76	4.84
	total	30.58	2.35	38.80	3.66
Lexicon	Treatment	18.40	3.56	32.30	2.18
	Group control	15.50	3.69	18.83	2.34
	total	16.95	3.60	25.56	2.27
Auditory memory	Treatment	8.70	2.01	17.90	2.82
	Group control	8.66	1.91	9.26	2.04
	total	8.68	1.94	13.58	2.44
visual memory	Treatment	9.50	2.16	16.26	3.12
	Group control	10.03	2.45	10.26	1.92
	total	9.76	2.30	13.26	3.97

Table 3: Confirmation of MANOVA data summary for control and treatment groups

Effect	Tests	Value	F	Hypotheses (df) degrees of freedom	Error (df) degrees of freedom	P
Intercept	Pilai's trace	0.847	75.863	4	55	0.00
	Wilks' lambda	0.153	75.863	4	55	0.00
	Hotelling's trace	5.517	75.863	4	55	0.00
	Roy's largest root	5.517	75.863	4	55	0.00
Group	Pilai's trace	0.817	61.285	4	55	0.00
	Wilks' lambda	0.183	61.285	4	55	0.00
	Hotelling's trace	4.457	61.285	4	55	0.00
	Roy's largest root	4.457	61.285	4	55	0.00

Table 4: MANOVA results of treatment and control groups in pronunciation disorder, lexicon, auditory and visual memories

Reference	Variables	Sum of squares	Degree of freedom	Mean of squares	F	Level sig.	Eta coeficient
Revised model	Pronounciation disorder	4878.01	1	4878.01	59.06	0.00	0.50
	lexicon	1674.81	1	1674.81	32.98	0.00	0.36
	Auditory memory	1109.40	1	1109.40	108.69	0.00	0.65
	Visual memory	640.26	1	640.26	57.06	0.00	0.49
Intercept	Pronounciation disorder	4050.81	1	4050.81	49.04	0.00	0.45
	lexicon	4454.81	1	4454.81	87.72	0.00	0.60
	Auditory memory	1440.60	1	1440.60	141.14	0.00	0.70
	Visual memory	735.00	1	735.00	65.51	0.00	0.53
Groups	Pronounciation disorder	4878.01	1	4878.01	59.06	0.00	0.50
	lexicon	1674.81	1	1674.81	32.98	0.00	0.36
	Auditory memory	1109.40	1	1109.40	108.69	0.00	0.65
	Visual memory	640.26	1	640.26	57.06	0.00	0.49

As it is displayed in Table 4, the therapeutic software is effective on the reduction of pronunciation disorder ($P \leq 0.1$). It means that, the exercises available in computer software for Verbal-language disorder can solve the problem of articulation disordered children and can cause the children to commit less mispronunciation and phoneme substituting errors. This software has a significant effect on the increase of lexicon ($p \leq 0.01$). It means that the computer treatment software for Verbal-language disorder has a positive effect on the lexicon development of the children with delayed Verbal disorder. This software has the capability of the children's lexicon development in the categories of animals, fruits, objects, occupations, parts of body, diverse sounds, numbers, colors and clothes). Furthermore, the software affects the visual and auditory memory of children significantly ($p \leq 0.01$). Put another way, the therapeutic software for Verbal-language disorder has a positive effect on the improvement of auditory and visual memories of children suffering from Verbal-language disorder. This software can increase the auditory and visual memories of children from 2 items to 6 items.

DISCUSSION AND CONCLUSSION

Verbal disorders take great prominence among people particularly children. These disorders besides causing difficulties in routine activities of an individual, in long term create enormous emotional and psychological problems. According to the outcomes of the study, the efficacy of employing computer software on treatment of pronunciation and Verbal-language disorders was confirmed. In other words, the computer software for pronunciation and language disorder has a positive effect on the development of lexicon, auditory and visual memories in pronunciation disordered children and improves their performance. Hypothesis 1 (based on reducing effect of the therapeutic software for Verbal-language disorder) was supported at the level of ($p \leq 0.01$), which this outcome complies with the findings of prior studies (Canadian association of Verbal therapists, 2000, Hutchin *et al*., 2004, Richard, 2006). It indicates that, therapeutic software for pronunciation disorder and delayed Verbal-language development brings about a positive effect on treatment and reduction

of pronunciation disorders of children. Today, computer software plays a key role in instruction of exceptional and normal children. One of the functions of computer software is to help therapist in training children, particularly the children who have difficulty in pronunciation.

The privilege of the software lies in motivating child and the therapist for making further effort. The children with pronunciation disorders are confronted with the problems of making a distinction among the auditory phonemes and the correct pronunciation of those words which they have trouble producing them. Hence, all the treatment techniques for helping students have been taken into acount in this computer software. Additionally, hypothesis 2 (software for Verbal-language disorders has a significant effect on the development of lexicon in children with Verbal-language disorder) was confirmed at $p \leq 0.01$. The obtained result was in line with the outcomes of the studies undertaken before (Sama software of: welfare rehabilitation university, 2004; American association of Verbal and language, 2008; Richard, 2006). It means that software for pronunciation and delayed Verbal-language development disorders brings about positive effect on the development of lexicon in children with Verbal-language disorder. The following reasons can be mentioned as some causes for such effects: involving children's sense in training process via displaying picture, sound, color, motion, animation, the students being active in learning process, providing the child with adequate and immediate feedback after each choice, the repetition capability of program at every time to an unlimited extent, the possibility of controlling the speed of process, the feasibility of instruction either individually or collectively and finally access of children to all stages of instruction and the possibility of going back to the previous stages for further practice at home. The above components accompanied by simple running of the program, time-saving feature of sotware (Lerner and James, 2005) and the use of technology in instruction, all of them highlight the usefulness of employing computer in the instruction of children with Verbal-language delay. In addition, hypotheses 3 and 4 (treatment software for Verbal-language disorder significantly affects the auditory memory of children with language disorder), (treatment software for Verbal-language disorder significantly affects the visual memory of children with language disorder) were confirmed at $p \leq 0.01$. The results were concordant with the previous studies findings (Sama software of rehabilitation well-being university, 2004; The American association of Verbal-language, 2008, Richard, 2006, Hutchin *et al*., 2002, Gray *et al*., 2004, Tormanen and Takala, 2008), indicating that this software had a positive impact on the increase of auditory and visual memory of children with Verbal-language disorder. The auditory and visual memories are items that a child needs them to acquire and expand his or her language skills. Usually the children who suffer from Verbal-language or pronunciation disorders have difficulty in their auditory and visual memories. Hence, working in this field is one of the necessities of language learning. Memory increase includes two stages: 1- boosting the memory of children using two-word items to five-word items, 2-boosting their memory by uttering sentences and asking them to repeat them. All of the above mentioned points have been taken into account in the treatment of pronunciation and Verbal-language disorders. As a whole, the findings of the current study demonstrated that the software for "treatment of pronunciation and Verbal-language disorder" had a positive effect on the improvement of children with Verbal-language disorder. It is worth mentioning, our study is one of the few studies undertaken on this issue in Iran, in which we have made our effort to employ information technology in instruction of children with Verbal-language disorder. The comparison of the efficacy of this software with other available software programs (Sama software of Well-being Rehabilitation University, 2004), regarding its optimization is of paramount value. Allowing for further familiarity of students to computer, teachers training, the possibility of adding extra exercises to the software by the teacher himself while using the software, as well as having access to more adequate output for these children can increase the efficacy of this software and other similar methods of instruction.

REFERENCES

1. Rhea, P., 2007. Language Disorders From Infancy Through Adolescence. 2nd ed. London.
2. Dobres, R., L. Lee, J.C. Stemple, AW. Kummer and L.W. Kretschmer, 2008. Description of Laryngeal Pathologies In Children and Delayed Verbal and Language In Exceptional Children. Journal Verbal Hear Disorder, 3(55): 526-532.
3. Delakato, R., 2002. Verbal and Language Disorders in Children with Abnormal Anatomy. Journal Verbal Hear Disorder, 4(33): 432-433.

4. Moore, M. and S. Calvert, 2000. "Brief report: Vocabulary Acquisition For Children with Autism: Teacher or Computer Instruction." Journal of Autism and Developmental Disorders, 4(30): 359-363.
5. Kumar, D. and L. Wilson, 2002. Computer Technology, Science, Education and Students with Learning Disabilities. Journal of Science, Education and Technol., 2(6): 17-29.
6. Canadian Association of Verbal and Language, 2000. Sounds Pronunciation for Children with Verbal and Language Disorder. Journal Verbal Hear Disorder, 2(22): 111-130.
7. Hutchin, L.H., 2002. Look and Say Software for Children with Delayed Verbal and Language and Autism. Journal Verbal and Language Disorder, 4(22): 1234-1244.
8. Rushakoff, G.E. and H.S. Arthur, 2005. Clinical Assessment Software. Verbal Sounds on Cue for Children with Hearing Loss, Microcomputer Applications in Rehabilitation of Communication Disorders. Aspen, Rockville, MD, pp: 1-24.
9. Verbal and Language Association of American, 2007. Understanding Questions +Out Loud Software for Children with Delayed Verbal and Llanguage, American Association.
10. Smith, A.D. and S. John, 2005. The effect of Cognitive/Logical/ Deductive Reasoning Skills Software on Children with Failure in Memory and Perception. Journal of Verbal and Language, 12 (4): 1234-1245.
11. Lerner, J.W. and A. James, 2005. Computer Applications in the Field of Delayed Verbal and Language. Jounal of Psychol., 1(6): 121-123.
12. Seferian, R., 2006. Design and Implementation of a Software Training Program for Students with Learning and Behavioral Disabilities. Journal of Learning Disabilities, 6(23): 160-172.
13. Richard, P., 2006. Review of Computer Managed Articulation Analysis. ASHA, 2(28): 74-75.
14. Tormanen, R.K. and G. Takala, 2008. Learning Disabilities and The Auditory and Visual Matching Computer Program. Journal of Support for Learning, 2(23): 80-88.