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Expandable multimedia software for children suffering from dyslexia

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1. Introduction

15-25% of children in the world have difficulties with reading. [2] It can be caused by injury of vision or hearing, verbal or linguistic deficiencies, troubles in spatial orientation, recollection debility, debility in dividing talking into elementary parts, lack of concentration, motivation troubles or maybe the parents' relation to reading. [1]

In the presentation a program is introduced which promotes children (especially who suffer from dyslexia) to become acquainted with characters, words and reading. There is an external database belonging to the program and storing the exercises. The database contains texts to be read, pictures, animations, sounds and text files containing the result of pupils in a determinate directory system. Teachers can modify and expand this database arbitrarily, so they can compile tasks suitable for special claims. A further advantage of expandability is that the software can be rewritten in other languages without any programming. English and German versions are also being developed.

Writing and developing interactive multimedia programs are complicated and need a lot of time with conventional programming languages, e.g. with Pascal or C++. So the exercises were written in Macromedia Director MX, the setting panels in Borland Delphi. The latter one is a high level object oriented visual programming language which makes design of dialog boxes, processing text files and manipulate databases easy and fast. [3,4]

For treating the problems of children suffering from dyslexia there have been some programs made earlier as well. But for such a program, which is expandable, there were no attempts done. Many ardent teachers need to be able to compile tasks suitable for special claims. It is easy to do it with the external database. We also plan to prepare a teacher module that makes compiling new tasks, expanding and modifying the database even easier. The program is being tested by pupils of 6-14 ages

in several elementary schools.

2. Handling the troubles of reading

For the majority of children having problems with reading the trouble is caused by miss of several characters or not recognizing them. It is mainly occasioned by the unsuitable teaching methods how to read. But children who suffer from dyslexia have a mutation in the brain which makes it heavier to pick up characters. [3, 4, 5]

In Hungary Ildikó Meixner worked out methods to treat dyslexia. Her books underlie every dyslexia reeducation course. Since the 90's several computer programs have been developed as well. These lectures can be made more variegated with them.

3. Developing environment

When writing the program worksheets had to be processed. For this preparatory work and later for writing the program numerous developing environments were used.

A part of the texts had to be scanned, another part of them had to be typed from the worksheets. The typed texts were saved in Word in Rich Text format. Text recognition was performed with ABBYY FineReader whose test version could be downloaded free from the Internet.

The black and white pictures of the worksheets were scanned, the minor errors caused by scanning were corrected and finally, pictures were also colorized. The correction of errors and colorization were achieved with Adobe Photoshop. When choosing colors we endeavored to reach real body colors. Now the program contains more than 350 pictures colorized by us.

For recording sounds and filtering noises Sonic Foundry Sound Forge 6.0 was used.

Exercises were prepared in Macromedia Director MX, setting panels were made in Borland Delphi. Macromedia Director is a widely used multimedia developing environment, which combines the effectiveness of high level programming languages with the show of animation studios. Developing interactive multimedia programs is considerably complicated and takes a lot of time with conventional programming languages, such as Pascal or C++, but by the help of Director these applications can be written more easily and quickly. Delphi is a high level object oriented visual programming language based on Pascal. It is easy and fast to make different dialogue boxes and process test files with it. The simplified ER-model of the database of DysLearning is shown below. The program stores the name and the age of the students. If a pupil finishes a worksheet, the program records the date and the time of solution, the number of mistakes, the name of the worksheet and the text file which stores the results. All worksheets are described by text files which contain the texts needed to the sheet, foreground and background color, font size, pictures and animations belonging to the sheet, etc.



Figure 1: The simplified ER-model of DysLearning

4. The User Interface

The effective user interface of these programs increases the power of the users greatly. It is important that users have positive feeling and the work with computer does not charge them: they can use the application in a very simple way, and its appearance must be user-friendly. For the right solution the user receives bonus prize animation with a funny sound effect, so children would work with pleasure and pay attention to the joy of the game. (ISO-9241 standard)

5. About DysLearning

The program developed by us improves multifarious skills in a playful form. It is a great advantage that every text, picture, bonus prize animation and even the buttons are imported from external files, so these are exchangeable and expandable arbitrarily. Reading texts can be written – e.g. in Word – by anyone, pictures can be scanned or drawn, bonus prize animation can be made in the form of animated GIF's or downloaded from the Internet. A further advantage of the exchangeability is that the software can be rewritten to other languages (e.g. English, German etc.) without any programming tasks. As an English version of the program is also planned an English name was chosen for it: DysLearning.

The first one is the "Picture Wizard" where children have to draw a picture in accordance with the commands given below. Commands describe how many steps have to be made, and in which direction. It improves spatial orientation, attention functions, following direction, monotony tolerance. At the next task pupils have to read a short text which appears or disappears word by word or line by line. The goal is to read characters together and understand texts.

At the "Finding Words" certain words have to be searched in a word-jungle. It is an exercise for exact reading. [1]

The most difficult task is the "Ordering" in which sentences have to be ordered with the help of pictures. It develops understanding texts.

Pairing was made for the most little children where for every picture above another picture below has to be searched, which is identical. It improves the observation skill.

A little bit difficult task is pairing opposites. At the end of the task opposites appear also in text form. Pupils have to read them.

In the Expressions-Jobs expressions or jobs have to be pulled under the right picture. Both tasks expand the vocabulary of children.

The good solution implies bonus prize animation, of course. Beside the funny animations pupils receive oral praise as well.

The skill-improving program was made for (private) lessons. The teacher can choose a text to be read, set the font type and size; store the results of pupils in separate files that enables tracing of their development.

6. Expandability of DysLearning

When writing **DysLearning** it raised serious difficulties that the program be expandable but besides keep the easy usage and spectacle applied in the programs introduced previously.

In the software developed by us all of the texts, pictures and animations can easily be expanded and modified. The color of texts and backgrounds, the size of texts, pictures and animations and the speed of showing/hiding of texts can be set.

Of course, there are default settings for all exercises for the easy usage but these settings are changeable, therefore the application can be translated to other languages. The English and German versions of this software are just being translated.

Every task is described by a text file. On the left hand side the text file of one of the exercises of "Picture Wizzard" can be seen. The co-ordinate of the beginning point and the code-line which contains the commands have to be given. The computer interprets this command-line, so it can check whether a child has solved the task correctly. At the bottom the size of the grating can be set. In the Finding Words the words to be searched and those not to be searched also have to be given. The foreground and the background color also can be set.

🖉 dinoszaurusz - Jegyzettömb 💶 🔲 j	3 Mu25_6_(t6) - Jegyzettimb
#Kezdőpont (rácspontban: 0,0 a bal	#Keresett szavak
alsó sarok)	tél,köt,sok
8,8	#Nem keresett szavak
#Ábra leírása (a műveleteket vesszővel	hoz, lap, vél, húz, síp, vak, tíz, fél, méz,
választjuk el).	sas, kéz, fut, hab, kép, víz, bab, lép, bél,
JF 1,J 1,JL 1,L 1,BL 1,L 4,B 3,JF 1,F	zab, hív, pép, fal, pék, zúz, föl, pók, zaj,
5,BF 4,B 1,BF 1,J 2,BF 1,B 1,JF 1,J	lök, tép, jól, hét, bök, fék, tök, kap, főz,
1,JL 4,J 3,JL 8,J 1,JL 1,B 4,BF 4,L	bot, kék, fúj, köz
3,BL 1,J 3,F 2,BF 2]p,B 3	#Háttér színe R,G,B
#Rácsok nagysága 20=kicsi, 40=nagy	255, 255, 255
20	#Megjelenített betű színe R,G,B
	0,0,0
	#Kijelölt betű színe R,G,B
	255,0,0

Figure 2: Configuration text files of Picture Wizzard and Finding Words

7. Results

Exercises have been solved by pupils of the age 9-13 years. 13 pupils from elementary school had no problems with reading but 16 schoolchildren suffered from dyslexia. Children solved tests following the instructions of developing educators. We took care that difficultness of tests was of the same level for all students. However there were considerable differences in the speed of solving exercises, no matter whether a pupil suffered from dyslexia or not.

Now it was only investigated whether any significant difference could be found between the speed of solving exercises for pupils having dyslexia and for those having not. In order to compare these results the analysis of standard deviation values had to be performed by the help of F-test. For results having standard deviation values of similar magnitudes (satisfying the Hs0 hypothesis with a significant level of $\alpha = 0.05$) the t-test with two samples was applied, while for results having standard deviation values of considerably different magnitudes (satisfying the Hs1 hypothesis with a significant level of $\alpha = 0.05$) the Welch-test was applied.

It can be seen that there are significant differences between the control group and children suffering from dyslexia (satisfying the Hm1 hypothesis with a significant level of $\alpha = 0.05$). The exercises were more difficult for dyslexic children.

Dyslexic		Picture			Finding	Expressions.
children	Opposites	wizard	Pairing	Ordering	words	jobs
1	78	1921	168	190	52	564
2	85	1502	121	255	23	465
3	88	1765	250	305	34	545
4	117	1865	107	216	84	544
5	89	1775	205	134	76	535
6	80	1932	242	179	75	654
7	96	1854	165	173	72	663
8	72	1875	189	213	78	465
9	207	274	215	159	76	406
10	56	356	215	142	45	423
11	167	852	290	715	31	314
12	172	424	146	607	76	339
13	86	759	112	390	62	456
14	41	757	118	486	63	339
15	29	257	199	262	47	160
16	26	546	129	293	79	166
Mean	93,06	1169,63	179,44	294,94	60,81	439,88
Std.dev	50,95	688,39	55,23	171,7	24,16	149,33

Table 1: The speed of finding the good solution

8. Summary

For treating the problems of children suffering from dyslexia were made some programs earlier as well. But for such a program, which is expandable, there were no attempts. Many ardent teachers need to be able to compile tasks suitable for special claims. It is easy with our program. We also plan to prepare a teacher module that makes compiling new tasks even easier. The software will shortly be completed with a map exercise that improves the spatial orientation of children. We hope that this playful skill-improving software will help every child suffering from reading troubles.

Information technologies and multimedia is spreading increasingly in the field of education as a useful tool of teaching. Subject-specific softwares and CD-ROMs appear resembling an explosion. Examinations about the efficiency of multimedia applications are running and it is also analyzed how they can be fitted into teaching processes.

The great advance of teaching and skill-improving programs is that worksheets have to be created only once. However, many children can solve them. There is no need to copy, print or cut pictures or texts of worksheets and there is no need to put them into different envelopes. Therefore the usage of exercises is more comfortable and economical.

This modern technique plays an important role to motivate children. It is very efficient in applying improving exercises in the field of education of handicapped children. These programs help teachers to teach and pupils to learn with the help of effective user interfaces.

Control		Picture			Finding	Expressions,
group	Opposites	wizard	Pairing	Ordering	words	jobs
1	38	462	48	107	7	165
2	32	485	52	79	6	185
3	40	564	60	84	13	156
4	28	453	46	46	24	175
5	36	458	48	58	35	76
6	42	854	43	88	33	215
7	43	356	50	58	49	241
8	32	522	42	76	15	254
9	40	786	46	58	29	125
10	30	1054	34	76	14	154
11	96	296	64	153	25	102
12	37	220	56	99	22	98
13	43	271	62	57	24	78
Mean	41,31	$521,\!62$	50,08	79,92	22,77	$155,\!69$
Std.dev	17,17	$243,\!48$	8,61	28,39	12,08	58,68
F	8,81	7,99	41,18	36,59	4	6,48
$F_{1-\alpha}(\nu_1,\nu_2)$	2,62	2,62	2,62	2,62	2,62	2,62
Hypothesis	Hs1	Hs1	Hs1	Hs1	Hs1	Hs1
	true	true	true	true	true	true
\mathbf{s}_{c}	39,67	538,16	41,57	129,37	19,72	117,98
Т	3,4943	3,2248	8,3348	4,4512	5,1654	6,4512
$t_{1-\alpha}(n_1+n_2-2)$	2,3734	2,3734	2,3734	2,3734	2,3734	2,3734
t_f	3,8057	3,5052	9,2315	4,927	5,5083	6,9781
C	0,1226	0,1334	0,029	0,0325	0,2355	0,1597
F	15,1327	15,1574	15,0074	15,0093	15,5014	15,2266
$T_{1-\alpha}(f)$	2,4899	2,4899	2,4899	2,4899	2,4899	2,4899
Welch/t-test	Welch	Welch	Welch	Welch	Welch	Welch
Hypothesis	Hm1	Hm1	Hm1	Hm1	Hm1	Hm1
	true	true	true	true	true	true

 Table 2: The speed of finding the good solution (control group) and the analysis of results

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