COMPUTER WORK INFLUENCE ON SOME CHARACTERISTICS OF CHILDREN PSYCHOMOTOR EFFICACY IN SCHOOL PUPILS WITH REGARD TO SOME SELECTED BIOLOGICAL AND ENVIRONMENTAL CONDITIONS.

by

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Computerisation causes not only positive but also negative aspects which constitute some problems not only for adults but also for children. Children spent a lot of time at the computer, both at school and at home. The research goal, was the assessment of the influence of a two hour work session on psychomotor aptitude in children aged 13-15.

Research included 98 pupils (49 girls and 49 boys) of 7th and 8th grades of two primary schools of Wrocław. Examined subjects attended two hours long IT classes during which they worked with computer. For each pupil, the tests were performed twice a day-before and after the job.

The results were analysed separately in accordance to sex, access to the computer and ability of learning.

Statistical analysis of results helped to form the following conclusions:

In comparative studies, psychomotor efficacy before and after two hours of work with a computer tended to worsen which was observed in delayed reaction to light and sound stimuli in girls as well as the number of committed errors in differentiating reaction in boys. Psychomotor efficacy of the group with the computer access outside the school did not differ significantly from psychomotor efficacy of children without it. School learning results did not have much in common with psychomotor efficacy of the examined children.

Key words: Psychomotor fitness, biological development

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Introduction

Ability to operate the computer is an important skill in contemporary world. More and more contemporary computer programs oblige to gain computer skills. This ability is often a criterion in qualifying young people to schools and universities as well as to professional jobs.

Majority of items of very broad literature concerning operating computers discuss its influence on adults organism (Bugajska et.al. 1997, Salomon et.al. 1997) and only some of them refer to children and youngsters (Boroń et. al. 1996, Głuszkowa et. al. 1996, Zyss et. al. 1996). Even children before the age of 7 can spend a few hours a day in front of the computer.

These studies aim at the assessment of computer classes influence on some characteristics of children psychomotor efficacy. Due to some problems of such surveys organization, 'natural' model group was used taking a class of children with two hour IT classes.

This goal realization, which can be continued in long time prospective studies, was started with forming the question whether two hour computer operating has any influence on psychomotor efficacy of the whole examined group aged 13-15. Another issue is whether there is any difference before and after computer operating depending on sex, access to the computer outside the school and whethe0r there is any connection between psychomotor efficacy features and school learning results.

This problem is of an utility importance as it can determine IT classes position in the time table.

Reaction time evaluation was used in the surveys realization as it can be useful in nervous system functional condition evaluation and is complementary with both neurological and electrophysiological examinations (Pietraszkiewicz et.al. 1992, Elsass 1986, Evarts et.al. 1981).

Material and methods

The studies were carried on 98 pupils (49 boys and 49 girls) from two primary schools of Wrocław. They were pupils of 7th and 8th grades aged 13-15 attending two hour IT classes in the morning hours. The classes took place in a well lighted and isolated from noise place. Evaluations were done on every pupil twice a day: directly before the classes and just after them. In order to eliminate any additional factors, the children were not overloaded with any physical effort or psychical stress before the tests. During the classes, they performed the exercises like 'dialogue with the computer' which was based on clicking commands and eliciting the answers.

The children selected to the examinations were of the height and weight between 10 and 90 centile in accordance to the standards defined by Waliszko (Waliszko et. al. 1980). The average body mass for 8th grade pupils was girls-51,5kg and 162,61cm and boys-53,75kg and 165, 15cm. The average weight and height for 7th grade pupils was girls- 52,00kg and 155,31cm and boys-44, 05kg and154,33cm. Besides, the examined pupils were characteristic for normal vision and hearing abilities.

Control group was not used in the study as double examination was treated as the control.

The studies estimated times of reaction to light and sound stimuli with the usage of reaction times meter MRK-80. The following values were assessed: simple reaction to light stimuli, simple reaction to sound stimuli as well as differential reaction.

Simple reaction examination based on emission of 30 sound signals at the same interval in the same time. After each trial completion, MRK-80 meter showed reaction total time, reaction average time as well as the number of committed mistakes.

Differential reaction examination based on exposing 30 light signals within 120 sec. consisting of 20 red signals (positive stimulus) and 10 green ones (negative stimulus).

In the case of simple reaction examination, the pupil's task was pressing reaction key with the thumb of the dominant hand at the moment of stimulus perception.

In the case of differential reaction, the pupil's task was pressing reaction key with the thumb of the dominant hand at the moment of positive stimulus perception and not reacting to negative stimuli which appeared among positive signals.

The following values were assessed: reaction time average value, number of correct answers, number of committed errors reaction to a green signal was regarded an error as well as no reaction to a red signal.

Examinations were done twice during the day: before and after the job with the computer.

Room illumination was 500 lx. During psychomotor tests, the examined person was sitting in front of the light exposure in the distance about 0,5m, keeping a reaction key in the dominant hand. Examinations were carried on with both eyes open. Before the tests, the children were acquainted with the task and all the rules were explained and demonstrated. The children were called in pairs- one person was performing the task whereas the other was looking closely. The aim of such a procedure was elimination of unfavourable emotional conditions as well as getting used to the coming task.

Statistical analysis was carried on with the usage of the following methods:

- centre tendency of the examined parameters was established with the usage of arithmetical mean and standard deviation,
- in order to estimate observations differences significance of the same pupil tests, t-Student test for dependent groups was used ; comparison of observations for independent groups was done with the usage of t-Student test for independent groups.
- significance of relations between measurements of characteristics of various nature was established with Pearson's linear correlation coefficient analysis.

Results and discussion

The results were analysed:

- basing on parameters mean values elicited before and after two hour work with the computer,
- in accordance with examined pupils sex,
- in accordance with access to the computer outside the school based on the history given by children,
- in accordance with learning results defined by key subjects average results.

Statistical analysis of the results enabled to state that light stimuli reaction time in the whole examined group increased statistically significantly after computer job completion and sound stimuli simple reaction time non-significantly shortened. (Tab.1).

Table 1. Average time of simple reaction to light and sound stimuli before starting and after finishing work with the computer.

Examined Characteristic	**Before the Job**		**After the Job**
Simple Reaction Time to Light Stimulus (milliseconds)	286,61 ± 26,18	← $I_{1\%}$ →	293,81 ± 31,71
Simple Reaction Time to Sound Stimulus (milliseconds)	194,25 ± 27,46	← N →	190,02 ± 27,60

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

Table2. Average time of simple reaction to light and sound stimuli before starting and after finishing work with the computer in boys and girls.

Examined Characteristic	**Girls**		**Boys**
Simple Reaction Time to Light Stimulus Before the Job (milliseconds)	292,67 ± 23,80	← $I_{5\%}$ →	280,56 ± 27,28
	↕ $I_{1\%}$		↕ N
Simple Reaction Time to Light Stimulus After the Job (milliseconds)	302,39 ± 28,80	← $I_{1\%}$ →	285,23 ± 32,44

Table 2

Simple Reaction Time to Sound Stimulus Before the Job (milliseconds)	197,26 ± 23,02	N	191,24 ± 31,22
	N		$I_{5\%}$
Simple Reaction Time to Sound Stimulus After the Job (milliseconds)	197,20 ± 28,44	$I_{1\%}$	182,83 ± 25,01

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

Table 3. Average time of simple reaction to light and sound stimuli before starting and after finishing work with the computer depending on access to the computer outside the school.

Examined Characteristic	**With Access**		**Without Access**
Simple Reaction Time to Light Stimulus Before the Job (milliseconds)	287,78 ± 26,46	N	289,81 ± 22,07
	N		N
Simple Reaction Time to Light Stimulus After the Job (milliseconds)	293,01 ± 36,13	N	294,71 ± 25,99
Simple Reaction Time to Sound Stimulus Before the Job (milliseconds)	193,09 ± 32,40	N	183,72 ± 18,80
	$I_{5\%}$		N
Simple Reaction Time to Sound Stimulus After the Job (milliseconds)	181,36 ± 22,92	N	183,29 ± 19,39

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

Reaction average times in the case of light stimuli differed statistically significantly for the groups of boys and girls both before and after computer job completion. Boys reacted quicker than girls. After the computer job completion both boys' and girls' reaction time was elongated, but statistically significant differences occurred in the group of girls (Tab.2).

During the trials of simple reaction to sound stimuli, boys were characteristic for statistically shortened time than girls after the computer job ending. In the group of boys, statistically significant shortening of reaction time was observed with sound stimuli after the job with the computer (Tab.2).

Analyzing mean values of simple reactions to sound and light stimuli, in accordance with computer access outside school, no statistically significant differences were found. In the case of sound stimuli simple reaction time, in the group of pupils with the access to the computer outside the school, statistically significant drop of reaction mean value was observed after computer job ending (Tab.3).

Defining linear correlation coefficient between learning results (score classes: 1-1,5; 2-2,5; 3-3,5; 4-4,5; 5-5,5) and sound and light stimuli simple reaction time, no statistically significant results were elicited (Tab.4).

Table 4. Learning results score correlation with the tests results before and after the job with the computer.

	Reaction Time to Light Stimulus	**Reaction Time to Sound Stimulus**	**Differential Reaction Time**	**Errors Number in Differential Reaction**
Before the Job	0,125 (N)	0,100 (N)	0,023 (N)	-0,329 ($I_{5\%}$)
After the Job	0,007 (N)	-0,007 (N)	0,019 (N)	-0,231 (N)

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

No control group was introduced to the studies as double trials were treated as the control.

The results cannot be easily referred to standard values. Standards of reaction times for children in different age vary a lot. On the basis of studies carried on 10 years old children, mean time of simple reaction to light stimuli is 340,5msec., to sound stimuli 247,5msec., and differential reaction average time 521msec. (Pietraszkiewicz 1981). In the studies of Sutyłło and Ziobro, sight stimuli simple reaction time was 290msec., to sound stimuli 260msec., and differential reaction time 380msec. (Sutyłło et.al. 1965).

In accordance with Atwell's and Elbel's studies, reaction speed increase is observed after the age of 17. Bellis claims that times of reaction to light and sound stimuli undergo shortening even up to the age of 30. (Geblewiczowa 1961). Sankowski found out that reaction time varies and it relatively does not depend on external influence (Sankowski 1991). Borodulin-Nadzieja, in turn, observed that psychomotor efficacy in impaired hearing children was generally poorer than in healthy children and it clearly depended on environment of living and learning (Borodulin-Nadzieja 1999).

Summing up the course of simple reactions, physiological pattern of reactions was defined: sound stimuli reaction time was shorter than light stimuli reaction time and red light reaction time remained within standards defined for grown ups and amounted to 200msec. (Borodulin-Nadzieja 1989).

It seems that manual skilfulness as well as sight and movement co-ordination of devoted computer games players is very good (Zyss et.al. 1996).

Table 5. Differential reaction average time as well as the number of mistakes in this reaction before and after working with the computer.

Examined Characteristic	Before the Job		After the Job
Differential Reaction Time (milliseconds)	416,88 ± 52,02	← N →	411,33 ± 53,76
Errors Number in Differential Reaction	1,57 ± 1,32	← $I_{0,1\%}$ →	2,17 ± 1,41

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

Table 6. Differential reaction time as well as the number of mistakes in this reaction before and after working with the computer in boys and girls.

Examined Characteristic	Girls	Boys	Girls vs Boys
Differential Reaction Time Before the Job (milliseconds)	417,61 ± 52,64	416,15 ± 51,93	N
Differential Reaction Time After the Job (milliseconds)	409,87 ± 49,19	412,79 ± 58,45	N
Before vs After	N	N	
Errors Number in Differential Reaction Before the Job	1,47 ± 1,37	1,67 ± 1,26	N
Errors Number in Differential Reaction After the Job	1,80 ± 1,21	2,55 ± 1,50	$I_{1\%}$
Before vs After	N	$I_{0,1\%}$	

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

In accordance with available literature, reaction time is strictly connected with sex and in men it is considerably shorter than in women (Stawarz 1984). Similar results were obtained by Sankowski on examining the children aged 7-11 (Sankowski 1992) as well as Żurek in children aged 9-11 years (Żurek 1996).

Differential reaction was analysis further stage. Stimuli differentiation process is based on stimulus perception, classifying it as a positive or negative one and choice of a proper answer (Geblewiczowa et.al. 1960). Stimuli differentiation is strictly connected with stimulation and suppression processes not only in cerebral cortex but also in sub cortical regions (Sutyłło et. al. 1965, Geblewiczowa 1960).

In the case of all the examined persons, differential reaction time after computer classes decreased statistically insignificantly (Tab. 5). No statistically significant differences were observed between boys and girls as well as in the groups with and without computer access outside the school (Tab. 6,7).

Table 7. Differential reaction time as well as the number of mistakes in this reaction before and after working with the computer depending on the computer access outside school.

Examined Characteristic		With Access		Without Access	
Differential Reaction Time Before the Job (milliseconds)	N (↕)	421,18 ± 52,68	← N →	415,59 ± 63,30	N (↕)
Differential Reaction Time After the Job (milliseconds)		410,42 ± 50,89	← N →	407,69 ± 64,76	
Errors Number in Differential Reaction Before the Job	N (↕)	1,90 ± 1,55	← N →	1,50 ± 1,20	N (↕)
Errors Number in Differential Reaction After the Job		2,34 ± 1,72	← N →	1,82 ± 1,06	

N – Statistically non-significant difference, $I_{x\%}$ – Significant difference level x%

Coefficient of linear correlation between learning score and differential reaction time was not statistically significant (Tab.4).

For this age group, no differential reaction standards were found. In grown ups, starting from the age of 19, differential reaction time amounts to about 250msec. (Borodulin-Nadzieja 1989).

Differentiating accuracy was estimated basing on errors number analysis.

Geblewiczowa and Ogórek state that women are characteristic for better differentiation than men which means that they make less mistakes. Shorter time of differential reaction time results in a bigger number of mistakes.

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